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WITH

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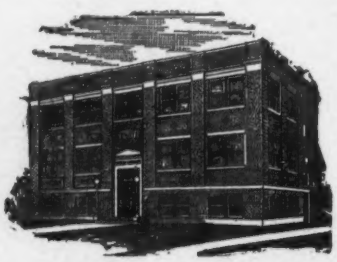

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SURGERY, GYNECOLOGY AND OBSTETRICS

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SNAPPING HIP

BY LEO MAYER, M.D., NEW YORK

THE condition known as snapping hip had been merely a medical term to me, until within several months four cases came under my observation. As their study brought out several clinical features, which the literature on the subject has not as yet presented, I feel justified in reporting them. They seem to me of peculiar interest, since taken as a group, they help clarify (1) the pathology of the condition, (2) the successful nonoperative treatment of the condition, and (3) a successful mode of operation.

I shall describe the cases in the order in which they came under my observation, so that the reader may follow my original line of thought. After these casuistical data have been discussed, in conjunction with a summary of the literature, it will, I think, be possible to gain a clear conception of the pathology of snapping hip and of the principles underlying its treatment.

CASE 1. H. R., male, age 20. The patient, a muscular, well-developed young man, reports that for 4 or 5 years he has been aware of a snapping noise produced by the right hip. He is able to produce this peculiar snap at will, by bending slightly at the hip and turning his leg outward. He can prevent the snap when bending and rotating by a slight abduction. Examination showed that the snap occurred when the thigh produced an angle of 150° with the body. The sound was so loud that it could be heard at a distance of 20 to 30 feet. It gave the effect of a distinct dislocation. After the patient had gone through the manœuvre to elicit the snap several times, he complained of some soreness; otherwise he was free from pain.

X-ray examination was made with the special view of determining whether there was any change in the relations of head and acetabulum before and after the snap occurred. I had expected, owing to the loudness of the report and the impression it gave of a dislocation, to find some change in the bony configuration, but to my surprise both the femur and its socket appeared absolutely normal, and there was not the slightest change in their relative positions before and after the snap.

A closer analysis of the phenomenon then showed that, as the patient produced the snap, there was a sudden passage of a strong, fascial band forward, and of the great trochanter backward. Immediately preceding the snap, the band could be felt posterior to the trochanter, upon which it seemed to impinge. Then, as the patient bent a little further, the band seemed released from the bony projection which held it in check and it slipped forward, much as a bowstring snaps, as the archer's hand lets the arrow fly.

Before consulting the literature, I deemed it advisable to work out for myself some mode of controlling the snap. I tried various manipulations and soon discovered that firm pressure just posterior to the trochanter produced a marked diminution in the shock and frequently entirely prevented the snap from recurring. To maintain this pressure, I applied firm adhesive plaster strapping with a large felt pad placed back of the trochanter. The adhesive straps were passed in the same direction as the fibers of the gluteus maximus muscle. With this simple bandage the patient was able to walk about with little or no inconvenience.

CASE 2. The second case was similar to the first, except that the snap was not nearly as loud. The patient had noted some trouble for 2 or 3 years, but it had not bothered him, until 2 or 3

months ago; then he began to feel marked soreness, owing to the constant snapping of the right hip. Here too, examination gave evidence of the slipping of a strong band forward over the trochanter. The X-ray, taken both in standing and in lying, before and after the snap, showed normal relationship between the femoral head and the acetabulum. Figure 1 illustrates the patient's method of producing the snap voluntarily. He stands on the right leg, lets the pelvis sink toward the opposite side, in other words, adducts the right leg slightly, and then flexes slightly at the hip. The adhesive plaster strapping again relieved, but as the patient wished some permanent form of appliance, a pelvic cradle was designed, to apply the pressure back of the trochanter. Figures 2 and 3 illustrate the apparatus used. A pad which could be screwed firmly back of the trochanter was held in place by the usual leather-molded pelvic cradle. A strong perineal strap was found necessary to hold the trochanter piece in the proper position. Four months later, the patient wrote me that the apparatus had entirely prevented the snapping from occurring and that except for the slight inconvenience of wearing it, he had no complaint.

CASE 3. The snap in this case developed through my own fault and directly under my own observation. The patient, a well-developed man of 24, came to me, because of an elbow stiffened by a gunshot injury. In the course of the arthroplastic operation, I removed a strip of fascia and fat from the upper portion of the left thigh, to cover over the newly formed articular surface of the humerus. The strip measured about 2 by 4 inches and included a portion of the fascia lata. The elbow operation resulted in 90° range of motion. The patient was up and about for a week, when he complained to me of a peculiar sensation of the left hip. He said he felt something snap with each step. Careful examination showed that a snap did occur and that, as in the previous cases, this seemed due to the sudden passage of a band over the trochanter. A firm adhesive plaster strapping was applied in such a way as to reinforce the gap in the fascia lata, and the snap at once disappeared. After a few days, when the strapping was removed, the snap again recurred, but after the patient had worn the strapping continuously for 2 or 3 weeks, the snap disappeared entirely.

CASE 4. In this, the final case of the series, the patient, a girl of 14, had noted the snapping for about a year. It caused her no pain whatever, but annoyed her exceedingly and made her self-conscious. The snap was not loud, nor constant. It occurred so far as I could judge about once in every 10 steps. The X-ray again showed normal relationships.

In this case also the adhesive plaster strapping proved entirely adequate in preventing the snap, but as the patient was anxious to be rid of all appliances and as an operative correction seemed to me possible, she consented to operation. Figure 4 illustrates the incision. This was made just back of the trochanter in the line of the fibers of the gluteus maximus. The fascia lata was divided obliquely, in the line of the fibers of the gluteus maximus. No peculiar thickening of the fascia could be noted, nor was it possible, under anæsthesia, to elicit the snap. The fibers of the gluteus maximus were separated bluntly until the great trochanter was exposed. The bone seemed to be more prominent and somewhat more irregular than the normal. The margins of the divided fascia were then sewed to the trochanter; the upper margin above, the lower margin below, leaving a gap of about one-half inch between the two fascial edges (Fig. 5). A plaster-of-Paris spica was applied and kept on for 4 weeks. The patient was allowed out of bed after the third week. For a week or two, after removing the plaster, she complained of slight stiffness, but within 6 weeks after the operation the hip was normal. She never experienced a snap after the operation, nor did it occur during the year in which she was under my observation.

ANATOMY

All four cases were associated with some abnormality of the fascia lata which caused it to catch back of the great trochanter. Other cases of snapping hip have been described in which the snap was supposedly due to an irregularity of the acetabulum which allowed a subluxation to take place. Cases of this type are exceedingly rare and in very few has convincing evidence of the pathological lesion been presented. As I have had no chance to observe cases of this type, I shall confine discussion entirely to those instances of snapping hip caused by the fascial anomaly. Zur Verth was the first to call attention to a normal thickening of the fascia lata running longitudinally from the iliac crest downward just in the line of the posterior margin of the great trochanter (Fig. 6). This thickening can readily be demonstrated by making a longitudinal slit in the fascia at the level of the trochanter and passing the finger backward underneath the fascia. A ridge is then palpable on the deep surface of the fascia. If the leg be adducted, the fascia and this band are rendered more tense and press firmly against the bone; conversely during abduction the fascia is relaxed. To this thickening Zur Verth applied the term *tractus cristo femoralis*.

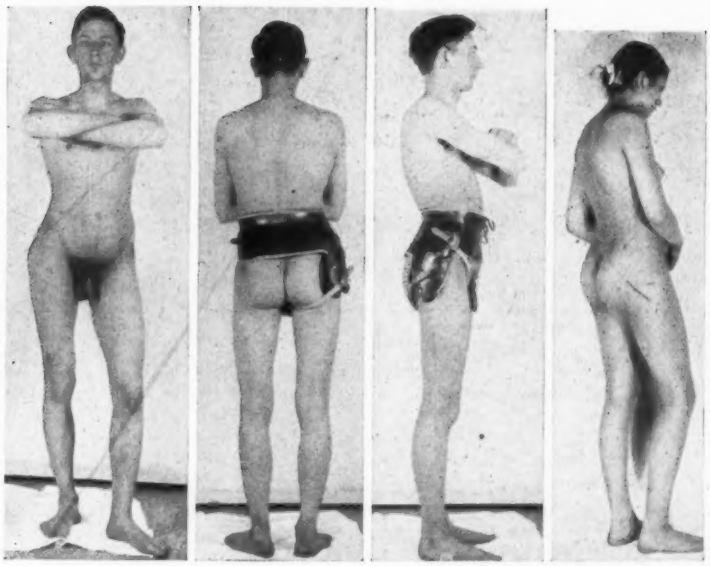

Fig. 1. Fig. 2. Fig. 3. Fig. 4.

Fig. 1. Photograph of Case 2 illustrating the posture assumed by the patient when voluntarily causing the hip to snap.

Figs. 2 and 3. Photographs of Case 2 illustrating the pelvic girdle and pressure pad used to prevent the snap from occurring.

Fig. 4. Photograph of Case 4 illustrating the operative incision. The horizontal line indicates the level of the tip of the trochanter.

PHYSIOLOGY

The mode of production of the snap is as follows: With the body weight resting on the pathological hip, the pelvis sinks toward the opposite side (Fig. 1). In other words, an adduction of the pathological thigh takes place. This causes the tractus cristo femoralis to press firmly against the bone and to catch just back of the posterior border of the great trochanter. As the thigh is now flexed on the body, the trochanter passes backward, as illustrated in Figure 7, carrying with it the fascial band which thus is rendered more taut, in exactly the same way as a bowstring is tightened by the pull of the archer's hand. When a certain degree of flexion is reached, the trochanter no longer can prevent the tightened fascial band from slipping forward. This it does with a snap (Fig. 7). An essential in this mechanism is complete relaxation of the gluteus maximus muscle, since if this is contracted, the fascial band is pulled away from the trochanter and is not caught by it.

PATHOLOGY

The anatomical and physiological data enable us to understand the pathological lesion which gives rise to the snap. Any condition which causes an abnormal thickening of the tractus cristo femoralis or unusual prominence of the trochanter, or an abnormal relaxation of the gluteus maximus muscle, may be the responsible factor. In Case 3, in which the snap developed subsequent to the removal of a strip of the fascia lata into which the fibers of the gluteus maximus muscle normally insert, it was unquestionably the relaxation of this muscle which caused the phenomenon. In Case 4 it was probably the slight prominence of the trochanter which is to be regarded as the essential lesion. A distinct pathological lesion is, however, unnecessary, since with

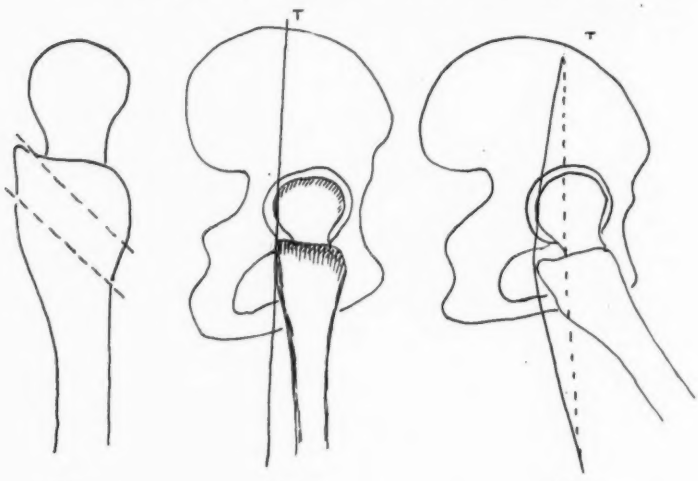

Fig. 5. Fig. 6. Fig. 7.

Fig. 5. Diagram illustrating by the dotted lines the way in which the fascia lata was sutured to the great trochanter in two parallel lines about one-half inch apart.

Fig. 6. Diagrammatic view illustrating lateral aspect of the femur and the position of the tractus cristo femoralis, *T*, when the leg is held in the straight position.

Fig. 7. Diagrammatic lateral view of the femur, as the thigh is being flexed. The trochanter carries the tractus cristo femoralis backward until the band becomes so tight as to snap forward into the position indicated by the dotted line. *T*, tractus cristo femoralis.

practice almost any one can learn to produce the snap by following the procedure outlined in the preceding paragraph.[1]

NONOPERATIVE TREATMENT

The principle underlying the treatment is preventing the fascia from catching back of the trochanter. In case the snap is due to relaxation of the gluteus maximus, the difficulty can be corrected by any measure which will overcome this relaxation, such as adhesive plaster strapping or a firm flannel spica. Firm pressure back of the trochanter will prevent the adduction which is the initial step in the production of the snap. This pressure can be exerted either by adhesive plaster and felt, or by means of a mechanical contrivance, as illustrated in the second case (Figs. 2 and 3).

OPERATIVE TREATMENT

The simplest mode of preventing the snap is the division of the tractus cristo femoralis and suturing it in such a way as to prevent it from forming again. This is the basis of the operations devised by Bayer, von Brunn, and Hohmann. In the case I operated upon, the fascia was divided below the level of the trochanter in an oblique line and the two edges of the incised fascia were sutured to the bone with a gap of one-half inch between them, so as to prevent them from reuniting.

[1] In a fifth case, which came under my observation a few days ago, the snap was due to muscular relaxation, owing to long disuse of the limb subsequent to a gunshot injury of the ankle.

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PENETRATING CHEST WOUNDS

REPORT OF 276 CASES TREATED IN A BASE HOSPITAL IN FRANCE

BY JOSEPH J. LEBOWITZ, M.D., AND WALTER H. NADLER, M.D., CHICAGO

THE following report, based upon the study of 276 penetrating wounds of the chest admitted during a period of 12 months to a base hospital in France, about fifty miles from the front, is concerned with the care of patients during an intermediate stage, from the time of admission from Casualty Clearing Stations to the time of evacuation to England. Observation of the average case was thus confined to a period extending from the sixth to the thirtieth day after injury.

At the clearing stations where chest injuries comprised about 2 per cent of the wounds admitted, resuscitation, transfusion and any urgent procedures indicated were employed. Cases which presented indications for primary surgery were operated upon. Closure of sucking wounds, removal of foreign bodies, particularly large foreign bodies, repair of diaphragm, excision and repair of lung tissue, evacuation of blood from the pleural cavity and closure of the chest wall by layers, were among the operations performed. These patients were held, if possible, at least 8 to 10 days or until they were in condition to travel to the base by ambulance train. When the number of admissions was very large, chest cases did not receive the usual attention and could not always be retained as long as was desirable.

The patients of our series were admitted to the base hospital on an average of 6 days after injury, although some arrived on the day of injury, and one as long as 46 days after being wounded. At least one clearing station attempted to retain these patients until they were fully convalescent. Even with these precautions many patients arrived at the base in poor condition which rapidly improved after 24 to 48 hours of rest.

At the base, patients were admitted to a ward reserved for their care where they received special attention in regard to comfort

Fig. 1. Large right hæmothorax with retained foreign body.

Fig. 2. Large left hæmothorax with retained shrapnel ball.

and diet. Many were very dyspnœic and cyanotic and required full doses of morphine for the relief of pain and restlessness. Dressings were changed as soon as possible. Patients with evidence of chest penetration, even without evidence of hæmo- or pneumothorax, were kept in bed. Cases were retained at least 30 days or until they were in condition to travel to England on stretchers.

Of the 276 penetrating wounds, 175, or 63 per cent, were simple hæmothorax cases of which 27 (15 per cent of this group) became infected; 71, or 26 per cent, were pneumothorax or hæmopneumothorax cases of which 23 (32 per cent of this group) became infected. The remaining 30 presented other variable symptoms and signs of penetration.

TYPES OF CASES 276

1. Simple hæmothorax 175
   a. Remained sterile 148
   b. Became infected 27
2. Pneumo- and hæmopneumothorax 71 (open 26, closed 45)
   a. Remained sterile 48
   b. Became infected 23
3. Miscellaneous cases 30
   Without evidence of hæmo- or pneumothorax.

Small, often inconspicuous wounds distant from the chest were occasionally found to have penetrated it, as in the case of wounds of the axilla, arm or face, in which the bullet followed a peculiar course due to the position of the patient at the time of injury. Hæmo- or pneumothorax was found in several instances on the side opposite the wound of entry, the bullet either having failed to penetrate the side of entry or having passed through it without producing a demonstrable lesion.

Physical findings suggestive of injury were not infrequently present on both sides in the case of unilateral wounds. Double hæmothorax occurred rarely. The findings of the uninjured side were more commonly due to contralateral collapse or pneumonia.

Wounds of the chest wall alone were capable of causing hæmoptysis, lung infiltration, pleurisy, empyema, and bronchopneumonia. Such cases were not included in the series.

The mortality of the 276 cases was 15, or 5.4 per cent. Four of these died as a result of associated spinal wounds of which 3 developed local meningitis. One patient with empyema and sepsis was admitted in a moribund condition; 1 showed at necropsy a pocketed em-

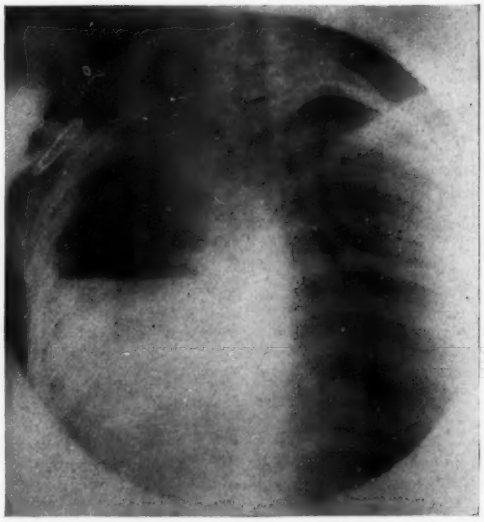

Fig. 3. Hæmopneumothorax of right chest.

Fig. 4. Large right hæmopneumothorax with retained foreign body.

pyema not previously located; 1 died of a pocketed empyema on the side opposite the wound of entry; 1 died of lung abscess and sepsis; 1 of pneumonia on the opposite side; 2 of empyema and pericarditis; 1 of associated suppurative hepatitis; 1 case with gas bacillus infection of the pleural cavity died 60 hours after rib resection; 2 patients died of hæmorrhage, 1 suddenly, the other after thoracotomy as a result of repeated hæmorrhages from an intercostal artery. Postmortem examinations were made in 10 cases.

HÆMOTHORAX

Hæmothorax occurred in 175 cases (63 per cent of the series). It is the most common event in chest wounds. Once the diagnosis of hæmothorax has been made, the early detection of an infected hæmothorax is the most important consideration, because by early drainage extensive pleural exudate organization with permanent loss of lung expansion can be prevented (1). Of our cases 148 remained sterile; 27 (15 per cent) became infected.

Every patient in whom the physical findings indicated the presence of fluid was aspirated as soon as possible after admission. All fluids were cultured. Sterile cases with small hæmothorax required no special treatment but where there was much fluid, repeated aspirations were sometimes necessary.

Infection occurred early from material carried into the wound, or late, in the second or third week, in cases which had seemed to be sterile, probably from the dissemination through the bloody fluid of previously localized infective agents. Apparently all cases are potentially infected.

The diagnosis of infection was often difficult. Practically all patients with penetrating chest wounds showed moderate pyrexia. "Late" infection was often manifested suddenly by rise in fever, pain, and dyspnœa, or more gradually by continued high fever and jaundice. Repeated aspirations at various levels were resorted to. It was necessary to bear in mind that pyrexia and other signs of sepsis might be due to external wound infection, external gravitation abscess, osteomyelitis of rib or scapula, retained intrapulmonary foreign body or to a coincident trench fever or pneumonia.

Cultures of the 27 infected cases of hæmothorax and of 12 cases of hæmopneumothorax showed: streptococci in 5, staphylo-

Fig. 5. Large right hæmothorax with retained foreign body.

Fig. 6. Large left hæmothorax, fracture of third and fourth ribs, retained foreign bodies.

cocci in 5, streptococci and staphylococci in 5, pneumococci in 4, pneumococci and staphylococci in 4, anaerobic bacilli in 2, streptococci and anaerobic bacilli in 2, diphtheroid bacilli in 5, and gas bacilli in 6 cases.

The sterile aspirated fluid consisted chiefly of defibrinated blood with the addition of a variable amount of exudate. Infected fluid contained more exudate with a variable amount of pus cells.

The physical findings were of interest, especially the high level of the diaphragm and the fixation and retraction of the wounded side, even with the presence of very small amounts of fluid, as well as the frequent presence, upon auscultation, of distinct breath sounds, tubular breathing and increased vocal fremitus over the dull area in patients from whom large amounts of bloody fluid were later aspirated. In these cases skodiac resonance was very pronounced. These findings differed markedly from those commonly seen in ordinary pleural effusion. They were ascribed to a condition of lung collapse which Bradford (1) considers "one of the leading if not the leading phenomenon of gunshot injuries of the chest." Such collapse, usually of the lower lobe, suggested by X-ray examinations, has been verified at operation and at necropsy. Collapse has also been described in wounds of the chest wall unassociated with hæmothorax and even in certain severe pelvic injuries as well as contralaterally in chest wounds.

One of our patients apparently developed complete collapse of the upper lobe on the injured side. Contralateral collapse of a lower lobe was diagnosed in 20 cases. All of these cleared up. One case, developing in the ward, was at first mistaken for secondary hæmorrhage because of extreme dyspnœa and collapse. The physical findings in all these cases suggested pneumonia, but there were no other points of resemblance. In typical cases the apex of the heart was drawn toward the collapsed side. As dullness and bronchial breathing decreased, râles and finally normal breath sounds were heard.

PNEUMOTHORAX

Pneumothorax occurred 71 times, 26 open and 45 closed. Of the open cases 13 remained sterile and 13 became infected. Twenty-one cases of open pneumothorax had been closed early before gross signs of infection were pres-

ent. Of these 9 (43 per cent) remained sterile and 12 became infected (1 of these had been closed at the base). The operation had varied from simple closure of a sucking wound to extensive visceral operations, with or without removal of foreign bodies. All except small sucking wounds had been closed completely in layers.

Thirty-three of the 45 closed pneumothorax cases remained sterile while 12 became infected. This group included hæmopneumothorax. The diagnosis of pneumothorax was made in the presence of subcutaneous emphysema associated with hyperresonance and suggestive X-ray findings.

FOREIGN BODIES

Most cases with suspected foreign body were radiographed. The majority of wounds, particularly those with retained foreign body were caused by shell fragments or "shrapnel," while apparently most of the entry and exit wounds were made by bullets. Extensive wounds with the exception of exit wounds over the scapula were caused, for the most part, by shell fragments.

There were 106 cases of entrance and exit wounds of which 91 remained sterile and 15 (16 per cent) became infected. Foreign bodies had been present in the thorax in 132 cases. The presence of a foreign body favors the development of infection. Fever, in 41 cases of retained foreign body in which no intrapleural infection could be detected, was probably due to small foci of infection about the foreign body. Except in 2 cases where the foreign body was found in the pleural cavity and diaphragm after thoracotomy, no attempt was made at the base hospital to remove intrathoracic foreign bodies.

SPECIAL SYMPTOMS AND COMPLICATIONS

Shock was mentioned in the early notes in 21 cases, probably only when severe. It was frequently noted in patients upon arrival at the base. *Hæmoptysis* was noted in 95 cases, usually as slight. *Subcutaneous (surgical) emphysema* was mentioned 61 times. It varied from small areas about the wound of entrance or exit to an involvement of the entire trunk. It sometimes subsided to recur later. Occasionally subcutaneous emphysema associated with one or more wounds of the chest was the only sign of lung penetration.

Serous effusion developed nine times, on the side opposite as well as on the injured side. It was successfully treated by aspiration. *Lung abscess* occurred in four cases, three of which recovered sufficiently to be sent to England. One died. One case of metastatic empyema also occurred. *Secondary hæmorrhage* was very rare; 3 cases were seen. *Pericarditis* complicated 4 cases, twice with the development of effusion. One died.

Intrathoracic and intra-abdominal wounds were associated in 10 cases. There were 6 chest wounds with associated spinal injury.

SURGICAL PROCEDURES

The surgical treatment of penetrating chest wounds, at the base, was confined, in general, to the treatment of complications chiefly of infection and particularly of infected hæmothorax, as well as to procedures that had been omitted or unfinished at the Casualty Clearing Station.

Practically all except small, clean entrance and exit wounds had required some operative procedure at the Casualty Clearing Station or required it later at the base hospital. Removal of foreign body from the chest wall, excision and cleaning of wound, and exploration for bone injury were usually performed in the forward area. Primary intrathoracic operations with complete closure gave promise of success only when performed on freshly wounded cases at the Casualty Clearing Station.

At the base hospital, all cases of hæmothorax in which bacteriological examination showed the presence of organisms, even though the patient presented no other signs of infection, were promptly treated by rib resection. Where cultures remained sterile after repeated aspirations at various levels, operation was not performed even though the patients appeared septic. Thoracotomy was performed in 32 cases, 31 times for the relief of intrapleural infection and once in a sucking wound. In 23 cases this was the first surgical exposure of the pleura; in 7 the operation was done for drainage of the pleural cavity follow-

ing closure by layers at the Casualty Clearing Station and in 3 cases to provide further drainage to chests in which resection had been done at the Casualty Clearing Station.

Three cases were operated upon under local, the remainder under ether anæsthesia. The most dependent portion of chest was chosen as the site for rib resection bearing in mind the frequent high level of the diaphragm. It was usually possible to select the eighth or ninth rib. Clots were evacuated from the pleural cavity. In 11 cases after irrigating the pleural cavity with eusol, Carrel-Dakin tubes and a large drainage tube were inserted and eusol instilled every two hours. The results were very good.

Primary closure was done in 2 cases. One later required drainage; the other died 24 hours after operation from an associated spinal injury.

CONCLUSIONS

1. The mortality of penetrating chest wounds that reached the base was low (5.4 per cent), due chiefly to sepsis, pocketed empyema and associated injuries.

2. These patients require treatment in special wards. Co-operation of internist, pathologist, roentgenologist and surgeon is essential.

3. Hæmothorax is the commonest event in chest wounds. Early diagnosis of infection is the most important duty at the base.

4. Thoracotomy for infected hæmothorax is the most frequent surgical procedure at the base hospital. Carrel-Dakin treatment for empyema gives good results.

5. Primary intrathoracic operations with closure may be performed early after injury—in the British Expeditionary Forces at the Casualty Clearing Station—in properly selected cases with no more danger than abdominal operations. Of 21 cases operated upon and closed, 9 remained sterile. It would seem that this type of case, in particular, should be retained for a longer period than was customary, to insure safety and comfort in travel.

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GUNSHOT INJURIES OF THE LUNG AND CHEST

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IT is known that gunshot injuries of the chest in war show a decreasing mortality the farther from the firing line they are observed. Duval states that at the first dressing stations the mortality is 25 to 30 per cent, where the deaths usually result from hæmorrhage or large defects in the chest wall with sucking wounds. The cases treated in the automobile surgical ambulances of the French had a mortality of about 20 per cent and in the stationary hospital farther to the rear an average mortality of 10 to 12 per cent was observed. This brings the total mortality to nearly 50 per cent and does not include deaths from late complications.

In presenting a group of cases observed in the base hospital, it is understood that the greatest loss by death has already occurred in the forward stations and that the chief benefit to be derived from the study of cases at the rear is in conjunction with the complications and their treatment and the probable functional results occurring in certain types of injury. As to the advisability of attempting to outline indications for operation at the front from observations made at the rear, there is considerable doubt, for every injury to the chest presents a rather acute problem in itself which is best appreciated by the men working at the front and which cannot be entirely sensed a week to a month later when the patient enters a base hospital.

Certain well-defined principles of treatment have been outlined and generally accepted for the early management of these cases. DePage has pointed out the fact that 60 per cent of the total mortality occurs in the first 5 days, so early treatment is indicated especially where operative work is necessary. The policy of early débridement of wounds and closure of all sucking wounds of the chest is accepted by all. Less clear indications are advanced for the removal of foreign bodies and the control of acute hæmorrhage. Some surgeons are much more enthusiastic than others in advocating the early removal of foreign bodies from the lung. It is well recognized that machine-gun-bullet wounds of the lung are less serious than those due to high explosive fragments and that machine-gun bullets are retained in the lung with less prospect of subsequent trouble developing. Duval believes that, as in other wounds, relatively large fragments of high explosive shell should be removed from the lung at the earliest possible moment and that cases with urgent hæmorrhage into the pleura or externally through a sucking wound should be operated upon and the lung sutured.

Of the 78 cases of gunshot wounds of the chest coming to Base Hospital 13, 11 patients had retained machine-gun bullets in the lung and 18 had retained fragments of high explosive in the chest, and of these it became necessary to remove 5 at the base because of complications which followed their presence. In contradistinction to this, only one case having had an operative removal of a foreign body from the lung or pleura reached our hospital. This may mean that few were operated upon on the American front or that the mortality was high.

In reviewing these cases a division between machine-gun bullet and high explosive wounds will be made. Perforating wounds of the chest and retained foreign bodies in the chest will first be considered and then a brief statement concerning sucking wounds of the chest, hæmothorax, and empyema will follow. The patients in this group arrived at the base anywhere from a few days to two months after their injury, but the majority came under observation on an average of a week after their injury.

PERFORATING WOUNDS OF THE CHEST

a. *From machine-gun bullets.* The 29 patients with perforating wounds of the lungs or pleura were relatively out of danger when they arrived at the base. From injury to the lung itself there were few complications, and pneumonia developed in only two cases.

Hæmoptysis occurred rarely after the first week and cough was relatively infrequent. In the early days after injury some pain in the chest and dyspnœa were usually present, but these symptoms were due for the most part to the fractured ribs which were present in 10 cases and to the hæmothorax which was present in 19 cases. Of prime importance to an uninterrupted convalescence is the question of the presence of fractured ribs. Not only do the ribs act as secondary missiles after being hit by the bullet, with consequent sucking wound of the chest or injury to the lung, but the liability to osteomyelitis with subsequent empyema is considerable. Hæmothorax generally occurred at the time of injury but there was little tendency for the hæmothorax to recur after aspiration at the base. When a pneumothorax accompanied a hæmothorax, it was usually possible to aspirate the air as well as the blood from the pleural cavity. In one patient who had no hæmothorax but a pneumothorax which completely collapsed the lung, the patient was placed on a fluoroscopic table so that the expansion of the lung could be observed. The air was then aspirated and the lung could be seen to expand so that it practically corresponded to the normal lung on the opposite side. Subsequent fluoroscopic examination demonstrated that the lung remained expanded and that the small amount of air left after aspiration had been absorbed. Empyema developed in only 4 cases and in all followed severe injury to the chest wall, such as a sucking wound or extensive fracture of the ribs. These were all drained by rib resections and did well, although all but one had sinuses when they left the hospital.

It was an agreeable surprise to note the general well-being of these patients on an average of two months after their injury. Whereas a number of them had physical findings due chiefly to moderate thickening of the pleura with consequent impairment of normal motion of the chest, the majority looked and felt well. At the rate of improvement most of them were showing it seemed probable that excellent functional results of the injured side might be expected. One patient with a transverse lesion of the cord with its inevitable cystitis, died of a bronchopneumonia. A few patients complained of dyspnœa on exertion but excluding the empyemas this symptom was well in the background and in most instances becoming less and less.

A tabulation of these 29 through-and-through wounds of the chest from machine-gun bullets is appended.

THROUGH-AND-THROUGH MACHINE-GUN BULLETS

Operations Performed at the Front	
Débridement of superficial wounds	6
Aspiration of hæmothorax	5
Closure of sucking wounds	2
Diaphragm sutured	1
Complications of the Injury	
Hæmothorax	19
Fractured ribs	10
Penetration of the diaphragm	5
Pneumothorax	4
Sucking wounds of the chest	2
Section of the cord	1
Subsequent Complications	
Empyema	4
Pneumonia	2
Treatment at the Base	
Aspiration of hæmothorax	12
Drainage of empyema	4
Examination of the Patients on an Average of 68 Days After Injury	
Walking or on duty	17
Moderate thickening of pleura	15
Partial or complete immobilization of the chest wall	8
Dyspnœa	7
Pains in chest	4
Sinus of empyema	3
Cough	2
Death	1

b. *From high explosive fragments.* A considerable number of these 17 cases were complicated by sucking wounds, varying in size from a small valve-like opening to a hole large enough to admit the entire hand. These were produced by fragments that ploughed through the chest tangentially. In about one-third of the cases there was fracture of the ribs, sometimes a mere chipping off of splinters, sometimes a crushing of a section of four or five ribs. In only a small number was a primary hæmothorax noted at the front, though it is reasonable to believe that some degree of hæmothorax must have accompanied practically every case. Perforation of the diaphragm was exceedingly rare and leads

one to believe that most of these men were injured in the upright position or else that practically all of those with penetration of the abdomen never got back to the base.

About two-thirds of these cases had been operated on at the front, either in a field or evacuation hospital, within 1 or 2 days after injury, the operations consisting in closure of the sucking wounds and débridement of wounds of entrance and exit. In no instance was a major thoracotomy performed or repair of a lung perforation or removal of blood from the pleural cavity attempted.

Practically every case in this group developed some complication after leaving the front. A few had only a simple hæmothorax which was in some instances extensive enough to produce complete lung collapse and displacement of the mediastinum with serious embarrassment of respiration. Empyema occurred in 65 per cent and only one of these followed pneumonia. Secondary hæmorrhage from the lung was seen in but a single case, which had been complicated by perforation of the diaphragm and formation of a biliary fistula between the lung and the liver. Pneumothorax, though noted in slight degree along with simple hæmothorax, was only once extensive enough to cause complete atelectasis and displacement of the mediastinal contents.

Secondary surgical interference was necessary in all but one of the complicated cases, the operations consisting in aspiration of those with hæmothorax or pneumothorax, drainage of the empyemas by rib resection or reopening of a sucking wound, and repeated blood transfusions in the case of secondary pulmonary hæmorrhage.

The end-results as the patients left our hospital were quite satisfactory. The final notations were made on the average at the eightieth day. At that time about 20 per cent had been doing full duty about the wards and the majority were ambulatory and in good condition; 60 per cent of the empyemas had a draining sinus still present. Practically three-fourths showed evidence of some degree of thickening of the pleura from either a hæmothorax or infected pleura. Approximately a half had noticeable immobility and retraction of the chest wall, but only a small percentage complained of dyspnœa, cough, or pain in the chest. The mortality of 5 per cent was due to the one case of secondary pulmonary hæmorrhage.

PERFORATING WOUNDS FROM HIGH EXPLOSIVE FRAGMENTS

Complicated by sucking wounds	7
Complicated by fractured ribs	6
Complicated by primary hæmothorax	3
Complicated by perforation of diaphragm	1
Total	17

Operations at the Front

Closure of sucking wounds	5
Débridement	7
Total	12

Complications at Base

Hæmopneumothorax	6
Empyema	10
Pneumonia	1
2d hæmorrhage	1
Total	18

End-Results on an Average of 80 Days after Injury

Duty	3
Ambulatory	13
Sinus	6
Thick pleura	11
Immobility of chest	9
Dyspnœa, cough, or pain	3
Death	1

Summary

1. One half to two-thirds of the perforating wounds of the chest, regardless of the type of missile were complicated by a hæmothorax.

2. Sucking wounds of the chest wall were present in 41 per cent of the perforating wounds of the chest from high explosive and in only 7 per cent from machine-gun bullets.

3. Fifty-nine (59) per cent of the perforating wounds from high explosives developed an empyema in contrast to 15 per cent from machine-gun bullets. The frequency of empyema after sucking wounds is an important factor in this connection.

4. Pneumonia followed perforating wounds of the chest in only 6 per cent of the cases.

5. There was a mortality of two patients, or slightly over 4 per cent, at the base in perforating wounds of the chest.

RETAINED FOREIGN BODIES IN LUNG OR PLEURA

a. *Machine-gun bullets.* Of the 11 patients reaching us with retained machine-gun bullets in the lung or pleura none had been operated upon at the front for removal of foreign body. Though practically all had a hæmothorax on the injured side, only two had been aspirated at the front and on entrance at the hospital embarrassment of respiration and moderate interference with heart action was noted in most of the patients. Bizarre symptoms were occasionally present, as in an officer who was unable to breathe without great effort upon bending his head forward toward his chest, though in normal posture he had no difficulty in breathing. As was the usual practice every hæmothorax was aspirated. If a very large amount of blood was present, it was removed at several sittings several days apart. We were of the opinion that none of these chests refilled after complete aspiration. Only one of these patients developed a pneumonia and none was complicated by a lung abscess.

As accurately as one could judge from physical signs and repeated stereoscopic X-ray plates, the missiles were well tolerated in the lung and after the initial reaction due to trauma, there was no evidence of fibrosis or cavity formation around them. In one case studied with repeated stereoscopic plates, it seemed certain that the position of the bullet had changed and that it was lying at a lower level in the lung. In another case illustrating the tolerance with which bullets were borne, a boy who had been wounded in the arm by a machine-gun bullet never knew (and it apparently had escaped notice at the front), that the bullet had penetrated the lung and mediastinum and was lodged in the lung on the opposite side. A moderate sized hæmothorax called attention to the retained foreign body.

Empyema developed in one-third of the cases, which is in contrast to perforating wounds of the chest from machine-gun bullets where only one-seventh developed empyema. Two of the cases had machine-gun bullets lying free in the pleural cavity and were removed when the empyema was drained. There was apparently no connection between the empyema and the retained foreign body in the other cases.

On an average of 68 days after injury these patients were last examined. Moderate thickening of the pleura over recent hæmothorax and small sinuses with thickened pleura in the empyema cases were present. In general the well-being of the patients was excellent and they were showing progressive improvement.

Operations Performed at the Front	
Débridement, superficial wounds	1
Aspiration hæmothorax	2
Complications of the Injury	
Hæmothorax	9
Fractured ribs	4
Sucking wounds	1
Subsequent Complications	
Empyema	4
Pneumonia	1
Treatment at Base	
Aspiration of hæmothorax	5
Drainage of empyema	4
Foreign bodies removed from pleura	2
Examination of Patients on an Average of 68 Days after Injury	
Walking or on duty	11
Moderate thickening of pleura after hæmothorax	5
Sinuses after empyema	4
Pain in chest	3
Deaths	0

b. *High explosive fragments.* Approximately one-half of the wounds caused by high explosives had fragments of the missile retained within the chest, the majority of which were in the lung itself and a few either in the pleural cavity or the mediastinum. The complications of the primary injury were of the same nature as with the through-and-through wounds, the percentage of sucking wounds, fractured ribs, and hæmothorax being about equal in the two groups.

Exactly two-thirds of these 18 cases had been operated on at the front, all within 48 hours after injury, except 3 cases, which arrived after the second day. The operations consisted in débridement of the superficial wounds, closure of the sucking wounds, and aspiration to relieve hæmothorax. In only two instances was thoracotomy done, one of

which was a successful removal of a foreign body from the pleura.

After leaving the front, secondary complications arose in two-thirds of the cases, of which over one-half were empyemas, a third pneumonias, and the remainder simple hæmothorax, lung abscess, gangrene of the lung, or mediastinitis. It is interesting to note that 3 of the 7 empyemas followed pneumonia.

All of these complicated cases required further surgical treatment. Aspiration, often repeated, relieved those with hæmothorax or pneumothorax, rib resection was done in cases of the empyema and lung abscess, and transfusion of blood at times was necessary. In over one-fourth of the cases, foreign bodies were removed from the chest either by a thoracotomy or through a persistent sinus. In one of these 5 cases the shell fragment lay in the mediastinum just to the left of the arch of the aorta.

As an average, the end-result was noted on the seventy-third day. One patient died of pneumonia. One-half of the total were doing full duty about the hospital. Practically all were ambulatory, had gained markedly in weight and were in excellent general condition. The majority of the empyemas were still draining through a small sinus. Over a half of the total number showed evidence of thickening of the pleura, which was in most instances sufficient to produce a noticeable immobility and retraction of the affected sides. Only two complained of pain in the chest, and one of dyspnœa or cough. Practically two-thirds of this group left the hospital with foreign bodies still present in the chest without material evidence of lung pathology.

RETAINED HIGH EXPLOSIVE FRAGMENTS

Total cases	18
Complicated sucking wounds	4
Complicated by fractured ribs	8
Complicated by hæmothorax	5
Complicated by tissue empyema	1
Complicated by perforation of diaphragm	1
Cases operated upon at the front	12
Aspiration	2
Closure of sucking wound	4
Attempted removal of foreign body	2
Débridement	9
Complicated cases	12
Hæmopneumothorax	3
Pneumonia	4
Empyema	7
Lung abscess	1
Gangrene of lung	1
Mediastinitis	1

End-Results — Seventy-third Day

Duty	9
Ambulatory	14
Sinus	5
Thick pleura	10
Foreign bodies in chest	13
Immobility of chest	8
Pain, dyspnœa, or cough	2
Death	1

Summary

1. In 29 cases with foreign bodies retained in the chest only 1 successful attempt at removal was made at the front, when a fragment of high explosive was removed from the pleura.

2. At the base it became necessary to remove two machine-gun bullets from the pleura because of empyema, one piece of high explosive from the mediastinum because of mediastinitis, and four high explosive fragments from the lung or pleura because of severe infection. One death resulted following operation due to bilateral bronchopneumonia.

3. Pneumonia developed in 5 of the 29 cases, all but 1 following wounds from high explosives.

4. Empyema developed in one-third of the cases with retained machine-gun bullets and in about one-half of those with retained high explosive fragments. Sucking wounds were present in about the same proportion in the two types of injury.

5. Twenty-two patients left the base hospital with retained foreign bodies in the lung with apparently no impairment of respiratory function.

6. Mortality of 1 case in this group of 29, or 3.5 per cent.

SUCKING WOUNDS OF THE CHEST

Sixteen patients had sucking wounds of the chest. Eleven were due to injury from high explosive fragments and 5 from machine-gun bullets. All but 3 patients had been operated upon at the front with closure of the

sucking wound. Although 5 had retained foreign bodies in the lung or pleura none had been removed. One patient had had an operative removal of a fragment of high explosive from his liver which had perforated the lung diaphragm. Nine of the patients had compound fractures of ribs.

The treatment at the base consisted of aspiration of blood from the pleural cavity in the 6 cases with hæmothorax, and drainage through the original wound or by rib resection in the 10 patients having empyema which developed from 2 to 30 days after injury.

Examined two months after injury these patients, with one exception, were doing light duty, and were in good general condition. All but one of the empyemas had sinuses and all had thickened pleura and more or less immobilization of the chest, but were in good general condition.

One of the patients in this group died at the base two months after his injury. A high explosive fragment had caused a sucking wound of the chest, had penetrated the diaphragm and liver. The shell fragment had been removed from his liver at the front but a biliary fistula persisted between the liver and the lung. In the course of his convalescence he had a number of pulmonary hæmorrhages for which he was transfused with blood. At postmortem a cavity the size of an orange was found between the lung and the visceral pleura containing bile and blood and connecting with the liver by a fistula.

Summary

1. Seventy per cent of the sucking wounds were due to high explosive fragments.
2. Sixty-three per cent of the sucking wounds developed an empyema.
3. Mortality of sucking wounds, 6 per cent.
4. The general condition of the patients after two months was good.

HÆMOTHORAX CASES

In the series of 78 gunshot wounds of the chest, 38 had a hæmothorax, 13 of which developed an empyema and 3 a pneumonia. It is difficult to say whether the empyemas were due to organisms lodged within the chest as a result of the primary injury, or whether the hæmothorax became secondarily infected by extension from some neighboring focus, such as osteomyelitis of the ribs. The fact that most of these empyemas developed early and that practically all cases that came to us with a simple hæmothorax remained clean, would make the former seem more probable.

The 23 remaining cases uncomplicated by infection while under observation in France, are here considered separately.

As to the cause of the hæmothorax, fractured ribs were noted in one-third of the cases, and sucking wounds in about one-fourth. The majority of the men had had through-and-through wounds from machine-gun bullets, though over one-third had retained fragments of high explosive or machine-gun bullets in the chest.

Operative treatment at the front had been necessary in only one-half of the cases and consisted in débridement of the superficial wounds, closure of sucking wounds, or simple aspiration of the blood. In no instance had a thoracotomy been done for removal of foreign bodies or clots from the pleural cavity.

After reaching the base, the surgical management was limited entirely to simple aspiration of the retained fluid. Occasionally a patient arrived in poor condition, having sufficient hæmothorax to cause complete lung collapse, displacement of the mediastinum and the signs of severe embarrassment to respiration. As a rule, however, the condition was less acute and there was ample time and facility to study the case fluoroscopically and control surgical management by means of the X-ray. The apparatus used at our hospital for aspirations consisted of a good sized bottle fitted with a two-way valve, one connected to the aspirating needle and the other leading by a long rubber tube to a water faucet. This attachment was made by a T-shaped connecting piece in such a way that by regulating the flow of water from the faucet the degree of suction through the needle could be accurately controlled. We found the apparatus to be useful not only for hæmothorax and empyema cases but for blood transfusion work as well.

Fig. 1. Pvt. Ira B. High explosive wound of chest with retained foreign body in mediastinum complicated by suppurative mediastinitis. Shell fragment removed under fluoroscope from mediastinum. Recovery.

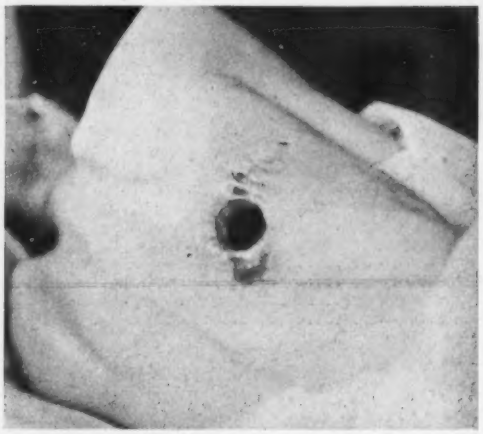

Fig. 2. Pvt. Oscar N. Sucking wound of chest from high explosive which was closed at the front but developed empyema and was drained through original wound. Picture 26 days after injury. Recovery.

CLEAN HÆMOTHORAX CASES

Total cases	23
Complications	
Complicated by pneumothorax	6
Complicated by sucking wound	5
Complicated by fractured rib	8
Total through-and-through wounds	16
Machine-gun bullets	13
High explosive	3
Total retained	7
Machine-gun bullets	3
High explosive	4
Cases operated upon at Front	11
Débridement	5
Closure of sucking wound	3
Aspiration	3
End-Result — Sixty-second day	
Duty	9
Ambulatory	12
Thick pleura	17
Immobility of chest	11
Pain	5
Cough	2
Dyspnœa	4

Ordinarily no trouble was encountered in doing these aspirations. With the patient in the sitting or lying position (depending on his condition), a medium-sized needle was inserted through a dependant intercostal space (the soft tissue being anæsthetized with cocaine) and the thin fluid blood easily drawn off. Infrequently difficulty was met in those cases that had never been previously operated upon and in which the hæmothorax had become to a large extent organized. In spite of the use of a very large needle or trocar it was impossible to remove more than a few cubic centimeters of thick clotted blood.

Ample opportunity was furnished, because of the delay in transportation of patients, to study the end-results of these cases after a considerable period of time. On the average, the final notations were made on the sixty-third day. At that time over one-half of the 23 cases had been doing full duty without apparent physical disability, and all the others were ambulatory except 2 who were confined to bed because of other injuries. Careful examination showed in a majority of the men evidence of thickening of the pleura, which in about two-thirds of the cases was sufficient to cause noticeable retraction and relative immobility of the affected side. Only a small number com-

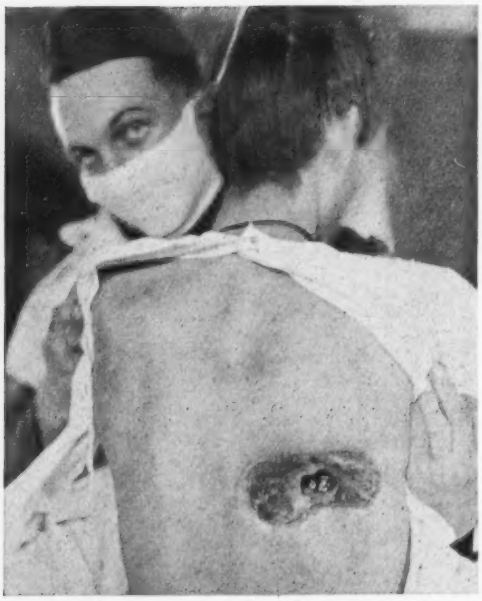

Fig. 3. Pvt. Thos. C. Sucking wound of chest from soft-nosed bullet. Closed at front but subsequently opened to drain empyema. Picture one month after injury. Recovery.

plained of pain in the chest, cough, or showed any signs of dyspnœa on exertion. The results were on the whole quite satisfactory. Those which had been aspirated at the front or early after reaching the first base hospital and kept free from fluid did remarkably well and when discharged showed little if any evidence of pleura fixation or functional impairment of the lung.

The few, however, which had reached the base with a hæmothorax so well organized that aspiration was not successful, were in considerable degree functionally disabled.

EMPYEMA

The incidence of empyema in gunshot injuries of the pleura or lung was relatively low, developing in one-third of the cases. In sucking wounds of the pleura the empyema developed a few days after injury in most instances and in from 15 to 30 days after the injury in cases with fractured ribs, hæmothorax or retained foreign body. The process was relatively benign as the mortality of 1 would indicate.

	High Explosive	Machine-Gun Bullets	Total
Empyemas	18	8	26
Original Injury			
Through-and-through wounds	10	4	14
Retained foreign bodies	8	4	12
Sucking wounds	7	3	10
Fractured ribs	8	5	13
Hæmothorax	6	8	14
Penetration of diaphragm	2	1	3
Previous Operations			
Closure sucking wound	7	1	8
Débridement	5	2	7
Aspiration hæmothorax	2	1	3
Thoracotomy	1	1	2
Followed pneumonia	3	0	3
Operations for Empyema			
Rib resection	12	7	19
Drainage through existing wounds	6	1	7
Removal foreign body	2	3	5
End-Result—Eighty-fifth day			
Moderate to marked thick pleura	17	7	24
Sinus present	13	5	18
Good condition	14	6	20
Walking	13	6	19
Retained foreign body in chest	6	2	8
Tachycardia	2	2	4
Dyspnœa	2	2	4
Cough	2	2	4
Pain in chest	3	2	5
Death	1	0	1

The highest incidence was found in sucking wounds of the chest, where 70 per cent of these cases developed empyema. Of the total number of empyemas, sucking wounds had been present in 40 per cent. Compound fracture of the ribs were present in one-half of the cases, and hæmothorax was present in the same degree. Perforating wounds of the chest and wounds of the chest with retained foreign bodies were complicated by empyema in relatively the same proportion. The most striking etiological factor seemed to lie in the character of the missile causing the injury. While the number of chest injuries was equally divided in our hospital between high explosive and machine-gun-bullet wounds, empyema was twice as frequent a complication in wounds from high explosives. Pneumonia developing after wounds of the lung or pleura played a very

minor rôle in the causation of empyema. Extensive operative procedures on severely wounded men, such as suture of the diaphragm, were frequently followed by empyema.

In treatment of this class of cases, a rib resection was done under local anæsthesia and tubular drainage employed in most instances. In the sucking wounds with empyema, drainage was usually sufficient through the wound already present. Where cavities were present they were irrigated with Dakin's solution.

The patients were examined last on an average of 3 months after their injury and 75 per cent of them were in good general condition. Nearly all had moderate to marked thickening of the pleura with more or less immobilization of the chest wall. Seventy per cent had sinuses but very few had large cavities. A few complained of pain in the chest, had dyspnœa, tachycardia and some cough. These usually were the cases which had had large sucking wounds or whose empyema had been insufficiently drained early in its course. Only one patient had died and his death was due to postoperative bilateral bronchopneumonia following removal of a piece of high explosive from the pleura, in which a large empyema had formed.

RESECTION OF THE LUNG FOR POST-TONSILLECTOMY ABSCESS[1]

By HOWARD LILIENTHAL, M.D., F.A.C.S., New York

THE accompanying report of extirpation of the right lower, middle and part of the upper lobe with subsequent atrophy, leaving no lung in the right chest, is thought to be of sufficient interest to warrant presentation.

The patient, Mr. W. A. B., age 26, was first seen by me on March 20, 1917.

About 15 months before, he had had his tonsils removed in general anæsthesia and about a week afterward coughing began with foul expectoration and occasional hæmorrhages. For days and even weeks at a time the patient felt fairly well and coughed but little. Then there would be an attack of fever, hæmorrhage, emptying of the abscess, and much coughing with the discharge of large quantities of fetid pus. His first hæmorrhage occurred about 6 weeks after the onset of the symptoms. At that time his general condition was good and his blood showed 4,300,000 red blood cells with 9,500 white cells. Within a few weeks, fifteen hæmorrhages, some quite copious, occurred. Occasionally there was an attack of "emptying" in which as much as a pint of foul pus was coughed up in a few hours.

In the beginning of the illness, pneumococcus was found in the sputum and autogenous vaccines were given with no apparent improvement; indeed, there was some hæmoptysis after each injection.

X-ray on July 17, 1916, resulted in the following findings: In the right chest, there was a cavity in the mid-clavicular line; an area of infiltration from the seventh to ninth ribs (middle lobe) with a cavity about the size of a walnut. Infiltration about 4 inches vertical by 3 inches horizontal. There was much infiltration into the lung tissue outside the zone of inflammatory reaction.

July 22, 1916: Blood count, 3,800,000 red blood cells and 10,000 white. The urine showed a few granular casts. A few days before this finding, the patient had had a hæmorrhage followed by a large quantity of pus which had accumu'ated for over a fortnight. There was relief for ten days.

On February 28, 1917, the patient's condition had become extremely bad and he decided to be operated upon. He had been confined to his bed since November, 1916, more than 3 months. (During all this time I had known the patient through his letters only.)

On March 5, 1917, he wrote stating that his temperatures were running between 100° and 103° and that he was expectorating a little blood each day and a large amount of pus.

On March 14, 1917, he came to New York and entered the Private Patient department of Mt. Sinai Hospital, where I first saw him. As a surgical risk he was most unpromising. His temperature was 104°; his pulse rapid; he was emaciated to the last degree; his eyes presented the peculiar glassy expression of approaching death and altogether he looked like a person in the last stages of tuberculosis although numerous examinations of sputum had failed to show acid-fast bacilli. An additional examination at Mt. Sinai was also negative. Wassermann examination negative. In spite of the length of his illness there was little clubbing of the

[1]Read before the American Association for Thoracic Surgery, Atlantic City, June 9, 1919.

Fig. 1. Lung involvement near second rib down to base. Right diaphragm drawn up by adhesions. Two fluid levels with great infiltration surrounding them. Left chest normal.

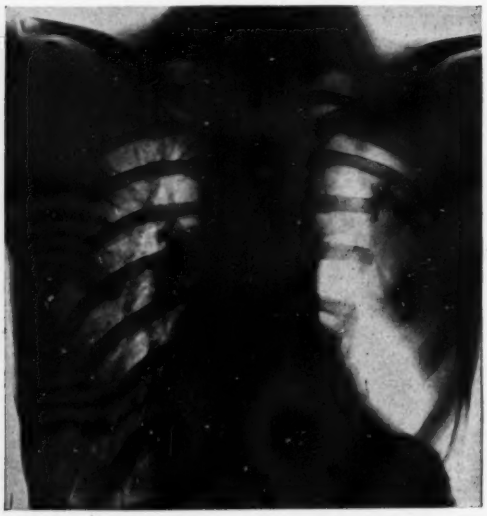

Fig. 2. After the operation but before healing of the wound. Note very small amount of lung tissue at right apex.

fingers. An X-ray now (Fig. 1) by Dr. Harry Wessler showed lung involvement from near the second rib down to the base where the right diaphragm was drawn up by adhesions. There were two fluid levels in cavities which looked about the size of small lemons, there being great infiltration surrounding them. The diseased area appeared to involve all three lobes. The left chest was apparently normal.

In spite of the patient's wretched condition, his spirit was unbroken and he begged to be given such a chance as surgery afforded. Indeed, it was because of his insistence backed up by the request of his family that I ventured upon what seemed like an almost hopeless effort.

Operation, March 16, 1917. First Assistant, Dr. Martin Ware. Anæsthetist Dr. Branower. Anæsthesia intrapharyngeal gas and ether. Bronchoscopy was first performed by Dr. Yankauer in the hope that he might be able to empty the abscess before the chest was opened. This proved impossible, however, the amount of pus being too great and the patient's condition too poor. Dr. Yankauer stated that most of the pus came from the lower bronchus which finding was at variance with our reading of the X-ray which indicated chiefly middle lobe suppuration. Just before the operation, the patient's blood pressure had been 100 systolic and 65 diastolic. The thighs near the body had been ligated with Esmarch's bandages in order to shut off the venous return and to segregate as much blood as possible in the lower extremities.

Procedure. A long seventh interspace incision was made with immediate resection of the greater part of the seventh rib and section posteriorly of the sixth. The chest contained a considerable quantity of straw-colored fluid which later proved to be sterile. The writer's rib spreader was now put in and a number of adhesions between diaphragm and lower lobes were divided between ligatures. All fluid was removed by suction and sponging. Exposure of the entire right thoracic cavity was perfect. Covering a part of the posterior portion of the upper lobe, there was a coating of lymph and below this lobe there was solidification of the greater part of the middle and lower lobes with the characteristic dusky color of the disease. The edges of the lower lobe were free and thin. In peeling away the upper from the middle and lower lobes a large abscess cavity was entered and the pus removed by suction. The lower and middle lobes and part of the upper were now ablated beyond mass ligatures of chromicized catgut and heavy silk, very little hæmorrhage resulting. During this process some pus appeared at the patient's mouth which was kept clear with the suction apparatus. The pulse now began to flag so the bandage around one of the thighs was loosened with immediate improvement. A little later the other bandage was removed and the pulse again picked up. The stump was carbolized and the ends of the ligatures which had been left long were fastened together and transfixed with a safety pin which was so placed outside of the chest as to anchor the mediastinum which could be seen at the bottom of the wound, through normal pleura, the heart being also plainly visible. A large fluff of iodoformized gauze was laid against the stump. On forcing the intrapharyngeal pressure, the upper lobe was seen to inflate in part. The wound was now

Fig. 3.

Fig. 3. Extent of wound a few weeks after operation. Patient up and about. With a retractor in this wound all parts of the chest could be easily observed.

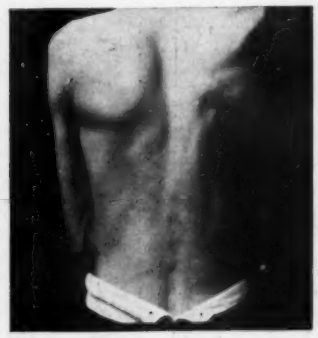

Fig. 4.

Fig. 4. Wound entirely healed at the time patient was exhibited. Note function of the right arm.

Fig. 5.

Fig. 5. View from front. Comparatively little asymmetry.

closed in two layers without drainage, the packing and the ligatures with their safety pin being buried beneath the skin so that at the end of the operation the chest was completely sealed. Before the last suture was tied a little more than a pint of paraffine oil was poured into the thoracic cavity and left there. The operation over, 500 cubic centimeters of citrated blood were transfused by A. O. Wilensky and Reuben Ottenberg, and the specimen was taken by Wilensky for study and examination.

There was no immediate reaction, the patient's pulse in the evening being 120, the respirations 24. He was kept well under morphine in order to slow the breathing for the first part of the postoperative time.

Fifty-six hours afterward the temperature rose to 102.8°, the respirations to 34, and the pulse to 144. I then removed some of the sutures at the posterior angle of the wound and inserted a drainage tube evacuating about a quart and a half of extremely foul blood-stained fluid. Relief followed.

Three days after the operation, I removed the iodoformized gauze. The patient had now improved a little, the thermometer registering 101°, the pulse rate being 130, the respirations 28, and the cough almost absent. From this time on, however, for a number of days he had a stormy time. All sutures had to be removed on account of a foul, sloughing condition in the wound.

Because of open bronchi, the Carrel-Dakin method could not be employed in this case, the patient almost strangling at the first attempt, although the stump had not yet come away.

The case now showed all the evidence of general gangrenous pleurisy. A catheter was inserted into the thorax and for several days a constant slow stream of oxygen was passed in the hope of combating the anaerobic infection. Respiration rose to 40 and the pulse to 140 in spite of considerable quantities of morphine. At the suggestion of Ware, I now packed the entire thoracic cavity with iodoformized gauze and three days later the surface began to clean off.

The wound opening was enormous so with the aid of a long retractor, all parts of the chest could be inspected daily.

Gradually the pungent odor of the anaerobic infection wore off and on March 29, 13 days after the operation, the stump came away easily and without hæmorrhage. It was noted that the remainder of the upper lobe was coated with fibrinous exudate.

On April 6, I resected the right phrenic nerve in the neck in order to paralyze the diaphragm, but as the subsequent X-ray study shows this muscle did not rise into the chest but was even flattened by the contraction of the organized exudate. At the same sitting I removed nearly the whole length of the eighth rib both to secure easier access for treatment and to aid in the collapse of the lower part of the chest.

Before the patient was discharged I resected a large part of the ninth and tenth ribs also and following this there was great discomfort with considerable abdominal pain which lasted for nearly two weeks.

The remaining part of the upper pulmonary lobe was apparently not functionating, probably because of the total absence of normal intrathoracic differential pressure and also because of the presence of the very large bronchial fistulæ.

From this time on the patient gradually improved and the wound slowly contracted. He returned to his work, that of hospital secretary, on July 16, 1917, exactly 4 months after his operation. When clothed, his figure looks symmetrical but naturally there is considerable contraction of the right chest. The wound remained open for nearly a year longer, then gradually closed, but reopened once or twice, and finally healed soundly.

February 28, 1919, an X-ray examination was

Fig. 6. Recent X-ray from behind. Very little lung tissue in right apex. Place of absent lung taken by pneumothorax.

Fig. 7. From the front. The mesial opacity in the right chest represents mediastinal tissues and probably left lung drawn to the right. Note curve of mediastinum above. Scarcely any lung shown in the right apex. Pneumothorax clearly marked.

made by Major Howard E. Ashbury, M.C., who reports as follows:

"There has been a resection of the sixth, seventh, eighth, ninth, and tenth ribs on the right with the removal of the greater portion of the seventh, eighth, ninth, and tenth ribs on the right. The chest wall is depressed at this portion and there is some new bone formation. There is no evidence of lung tissue in the periphery of the entire right side. There is partially aerated lung field close to the hilus. The left lung is apparently normal. There is some displacement of the heart toward the right. The diaphragm on the right is very much flattened."

The accompanying photographs and X-ray reproductions with their legends are self-explanatory.

After studying the specimen removed at operation in March, 1917, Abraham O. Wilensky, under date of May 15, 1919, reports the following:

"The specimen which was removed in March, 1917, consists of the middle (smaller piece) and lower lobes of the right lung. The upper half of the lower lobe is hard and indurated and contains the abscess cavity, which, originally, had been filled with a thick yellow pus. The open ends of the bronchi of the second and third order can be seen opening into the cavity.

"Microscopically there are (1) areas of round-cell infiltration in which the pulmonary markings are lost; (2) areas with thickened septa and dilated vessels; (3) areas as in (2) with alveoli filled with exfoliated epithelial cells. The bronchi are the seat of a suppurative bronchitis.

"The pleural fluid was clear yellow and, on standing, an albuminous clot separated out. It was bacteriologically negative. The pus contained numerous gram positive and negative organisms. Anaerobic cultures were unsuccessful."

Postscript. I had not seen this patient for more than a year and not until he appeared at the meeting. He was in excellent general condition and stated that he was able to dance through seventeen dances without undue effort and without shortness of breath. The closed pneumothorax shown in the X-ray was a surprise to me.

The physical examination was most interesting and the true condition of affairs would have been difficult to determine without the aid of the X-ray, since conduction of breath and voice sounds was quite perfect. The patient was examined by Dr. Lawrason Brown and other members of the Society.

A CONTRIBUTION TO THE SURGICAL PATHOLOGY OF RANULA[1]

By P. G. SKILLERN, Jr., M.D., F.A.C.S., Philadelphia

WHEN you hear the term *ranula* you immediately picture in your mind some sort of a cyst in the floor of the mouth beneath the tip of the tongue, but have you a clear conception of the source and origin of a cyst in this locality? Or have you a notion, more or less hazy, that there may be involved the duct of the sublingual or submandibular salivary gland, or the incisive gland, or the apical gland of Nuhn and Blandin? The following case, owing to the peculiar circumstances under which it was treated, offered an ideal opportunity for the study of the pathogenesis of ranula. The peculiar circumstances of treatment to which I refer are these. One year and three months before I first saw the patient she was operated upon elsewhere, and her sublingual and submandibular salivary glands both were removed without, however, relieving her of her condition, for it recurred. That the same lesion I encountered was present at the time the first surgeon operated is proven by reference to the description of that operation in his own words:

"Transverse incision below left mandible and parallel with it. Immediately under the deep fascia a cyst with paper-thin walls was encountered containing a thick, glairy fluid. It seemed to be connected in some way with the submaxillary or sublingual salivary gland, but as it was unfortunately opened during the section,—the walls collapsing to a cobweb,—it was impossible accurately to determine just what it was, whether a cystic hygroma or a retention cyst of a small part of the salivary gland. The submaxillary salivary gland as well as the sublingual were dissected out and the wound was closed."

The patient stated that 5 months after that operation the swelling reappeared and was the same as before the operation.

The patient, a female aged 28, was referred to me by Dr. Lennon. The previous history I have already given, except that the first hospital record did not state how long the patient had had the swelling previous to the first operation. Physical examination revealed in the left submandibular region a swelling that was not tense, but soft and fluctuating, which presented many of the characteristics of a cold abscess, namely, by the absence of the cardinal signs of inflammation, aside from the swelling. The skin over the swelling was normal in color, freely movable, and free from adhesions and indurations; the subcutaneous fat over the center of the swelling was as thick as at other points, showing no connection between the tumor and the skin, and no inclination of the contents of the tumor to reach the surface by "pointing." On opening the mouth there was seen beneath the left side of the tongue—in the alveololingual sulcus—a cystic swelling that bulged more and more as the submandibular swelling was pressed upon, until finally it occupied the entire sulcus from the frenum of the tongue to the second molar tooth. On releasing the submandibular swelling from pressure the sublingual swelling subsided to its former size, thus suggesting a direct channel of communication between the sublingual and submandibular swellings. There were no palpably enlarged regional lymphnodes.

Operation was performed under ether anæsthesia, and a T-shaped submandibular incision was made over the swelling: on reflecting the skin and superficial fascia there was exposed a lax cyst with a thin, bluish-white wall that bore a striking resemblance to the belly of a frog. The wall of the cyst was as thin as a sheet of bond paper. On opening the cyst there escaped a clear, glairy fluid that resembled nothing more closely than the white of a raw egg. The cyst contained about two ounces of this material, which was removed. The interior of the cyst could now be examined: its lining was smooth and lustrous, and wholly free from trabeculæ or other focal thickenings or points of degeneration. The empty cyst cavity could now be oriented: its mesial wall was in relation with the structures that form the floor of the carotid, but chiefly the digastric triangle; below, it extended as far as the thyroid cartilage; above and behind, as far as the stylomandibular ligament, which separated it from the parotid salivary gland; while above and anteriorly it narrowed down to a channel of the diameter of a lead pencil, which led the exploring little finger past the mylohyoid muscle upward to the floor of the mouth in contact with the deep surface of the mucous membrane stretching from the side of the tongue to the alveolar process, and from the frenum of the tongue backward to the second molar tooth.

No attempt to excise this cyst wall was made, but it was dealt with in the following manner: The orifice of communication through the mylohyoid muscle, corresponding to the constriction of an hour-glass, was tightly closed by a catgut suture, thus dividing the cyst wall into two cavities, an

[1]Presented before the Pathological Society of Philadelphia, May 8, 1919.

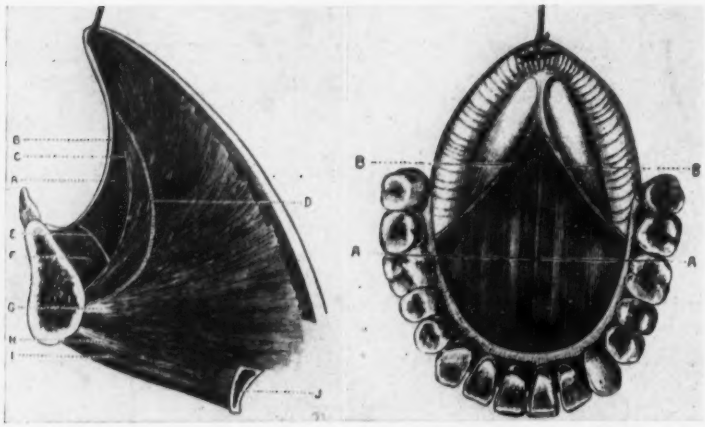

Fig. 1 (at left). Sublingual mucous bursa, called Fleischmann's, seen upon an anteroposterior section of the floor of the mouth. *A*, Cavity of the sublingual mucous bursa; *B*, its anterior or mucous wall; *C*, its posterior or muscular wall; *D*, the dotted line indicating the depth of the bursa; *E*, the duct of Wharton; *F*, the sublingual gland; *G*, the genioglossus muscle.

Fig. 2. Sublingual mucuos bursa seen from the front after one has previously raised the anterior or mucous wall. *A*,*A*, Interspace between the two genioglossus muscles; *B*,*B*, borders of the mucous bursa.

upper oral, and a lower cervical. The lower cervical was stuffed with gauze, aiming at adherence of its walls by obliterating granulation tissue. The upper oral cavity was marsupialized into the mouth cavity and likewise stuffed with gauze, with the same end in view. When last heard from, six weeks after operation, the patient described the site of operation as being "flat" and remaining flat.

Now Tillaux[1] raises the question as to whether or not ranula is the result of hydrops of the sublingual bursa, having no other connection with the salivary glands than that of neighborhood, and adds: "It is that which remains to be found out." I feel that my case answers quite accurately this last statement, for the swelling was proven to be wholly independent of the neighboring salivary glands, for the latter were removed at the first operation. As to the swelling in my case being attributable to hydrops of the sublingual bursa a possibility which Sir James Paget[2] in his *Lectures on Surgical Pathology* also mentions, let us recall just what the sublingual bursa, to which Tillaux refers, is, and just where it is. I have often noticed in examining the mouth how, when the patient curls back the tip of the tongue, the lax mucosa lining the sublingual space slides freely back and forth over the underlying structures: here, then, is a friction-site, and as elsewhere in the body where friction occurs, it is not unnatural that one should expect to find a bursa here, too. And such a bursa was, in fact, described by Fleischmann, of Erlangen[3], in the following words: "If from one or other side of the frenum one separates the mucous membrane from the tongue (Fig. 1), one finds close to the frenum, resting on the genioglossus muscle, behind the duct of Wharton and the ducts of Rivini, a small mucous bursa, oval-shaped, divided into cavities by cellular partitions, the sublingual bursa, *the existence of which it is important to be acquainted with for a knowledge of ranula*" (italics ours). This bursa is lined throughout with a distinct epithelium. Laterally it extends as far as the second molar tooth (Fig. 2).

Fleischmann was prevailed upon to find this bursa by Stromeyer, who was struck by the similarity of the contents of several ranulæ with the contents of other diseased mucous bursæ; having found it he thought the starting point of ranula must be sought

[1] Anatomie topographique, p. 326.

[2] Lectures on Surgical Pathology, 1854. p. 335.

[3] Schmidt's Jahrb., 1841, xxxii, 88.

in inflammation or other disease of the sublingual bursa; and he was even convinced that *ranula arises through disease of the sublingual mucous bursa alone* (italics ours), the salivary ducts only at times being involved in the same affection. Personally, from my experience with this and other cases, but particularly with this case, I feel very much inclined to agree with Fleischmann; in effect, my case, thanks to the absolute exclusion through the first operation of the salivary glands as pathogenetic factors or participants in the ranula, supports Fleischmann in every detail. Again, I was struck by the similarity of the fluid of my ranula to the white of a raw egg, a similarity that no stretch of the imagination can make for saliva. And it was Leopold Gmelin [1] who demonstrated that *the fluid of ranula has no similarity whatever with the saliva* (italics ours), sulphocyanic acid alkali being absent in ranula fluid, while ranula fluid is rich in albumin which does not occur at all in healthy saliva.

I imagine that much of the confusion that has arisen in the interpretation of the surgical pathology of ranula could be dispelled by restricting the application of the term to the condition described above and illustrated by my case, namely, to hydrops of the sublingual bursa of Fleischmann. Although the etymology of the term ranula is understood by the veriest tyro in Latin, namely, as the diminutive of rana, a frog, yet it would clarify matters somewhat to learn the exact condition to which the term was first applied: I was unable to find who first used this term, however. One surgical writer states that it is "possibly descriptive of the frog-like appearance of patients when the growth is very large"; another, that it has been derived "from the disease making the patient, as it were, croak when he attempts to articulate." Now, out of justice to my patient I must say that she neither looked like a frog, nor did she croak like a frog; but I will state unequivocally and in all sincerity that, when I reflected the skin flaps and exposed the bluish-white, thin and lax cyst wall, had a frog jumped out of the wound at this juncture, I should have considered the pathogenesis of ranula settled for all time to come.

What I wish to convey by this hyperbole is to stress in your minds my feeling that not every cystic swelling seen in the sublingual space should be described as a ranula just because it happens to occupy that space, but because its wall, when exposed, very closely resembles a frog's belly, and no such cyst that I have seen bears anywhere near as close a resemblance to the amphibious abdomen of rana as this hydrops of the sublingual bursa of Fleischmann.

[1] Woehler's u. Liebig's Annalen der Chemie u. Pharmacie, lxxiv, No. 1, 95.

ESTIMATION OF FATS, CHOLESTEROL AND SUGAR IN THE BLOOD OF THIRTY PREGNANT WOMEN

By HELIODOR SCHILLER, M.D., F.A.C.S., Chicago

PREGNANCY produces a voluminous increase in the metabolism and an augmented increase in catabolism. The variations in the constituents of the urine, the changes in the respiratory quotient, the increased heat production, resemble very closely the period of convalescence after acute diseases and greatly surpass the metabolistic activity during puberty.

To determine the cholesterol, the fat and blood sugar content of the blood, I examined the blood of 14 pregnant women in the later months of pregnancy, 10 at term, 5 after partus, and 1 in the third month of pregnancy. In doing this, I was well aware that similar examinations had been made by much more competent men than myself, but I had in mind studying these three substances parallel with each other in the same blood, a research, which, to my knowledge, had not previously been made.

Table 1 gives the blood sugar in 30 pregnant women during the last 2 months of pregnancy or during or soon after partus. It can be seen at once that there is no change in the sugar metabolism from the normal; in fact I can state, basing this on some other work done one year ago, that the amount of blood sugar is the same in all stages of pregnancy and the first few days after pregnancy, and is within normal limits. I had the opportunity to examine the blood of two pregnant women with glycosuria, and the percentage of sugar in the urine varied from 0.3 to 0.9. The sugar was discovered in the first woman at the sixth month, in the second at the end of the seventh month. Repeated examinations of the blood for sugar showed values from 0.082 to 0.089 per cent, surely no hyperglycæmia. Mammarian activity the first week or two after partus does not have a great influence on the blood sugar; the blood of the 5 women examined within 11 days postpartum had a sugar content ranging from 0.08 to 0.11 per cent within normal limits.

There surely cannot be a decreased liver function in so far as the sugar metabolism is concerned, a fact we hear so often mentioned in explaining some of the toxæmias of pregnancy. The part which the liver plays in sugar metabolism is normal. Nevertheless, there is not infrequently found during pregnancy a glycosuria of a small degree and the susceptibility to alimentary glycosuria during pregnancy, according to W. H. Morris in 37 per cent of the pregnant, is an established fact. The ingestion of even so small an amount as 60 grams of glucose will produce a glycosuria, so will the hypodermic injection of the smallest dose of adrenalin, in 38 per cent of the pregnant. But to explain this evidence of low sugar tolerance through an existing hyperglycæmia is incorrect. Hyperglycæmia in pregnancy is the exception. For an explanation of the above phenomenon of low sugar tolerance we must consider the increased adrenalin and thyroid and hypophysis function and the lowered ovarian function during pregnancy. The importance of the chromaffine substance in the mobilization of sugar, the frequency of glycosuria in the hypertrophic conditions of the hypophysis, the augmented activity of a series of internal secretory organs, the hypertrophic conditions of the thyroid (and hypertrophy and hyperactivity of all these organs is present in pregnancy) explain the low sugar tolerance and the cases of glycosuria without hyperglycæmia. I must mention that many authors consider the glycosuria of the pregnant as a renal disturbance, an increased permeability for glucose, or a physiologic hyperfunction of the kidneys.

After the fourth month of pregnancy a storage of fat takes place, not only in the fatty tissue but also in the blood, a storage needed for the nutrition of the fœtus. The total blood-fats, which constitute (1) the true fats — glycerides of the fatty acids; (2) phosphatides — lecthin, cephalin; (3)

TABLE I

Case No.	Age	Remarks	Time of Taking Specimen	Pregnancy	Blood Sugar, Percentage	Fatty Acids, Percentage	Cholesterol Percentage
1	34	Œdema of legs, 140 pounds vitium cordis	7 months	3rd	0.09	0.285	0.333
2	30	Heart burn, 130 pounds	8 months	2nd	0.077	0.379	0.220
3	25	Small woman, 106 pounds	8 months	2nd	0.077	0.315	0.415
4	24	Medium sized	7 months	1st	0.077	0.354	0.290
5	23	119 pounds	8–9 months	1st	0.118	0.355	0.146
6	30	Normal pregnancy, about 130 pounds	9 months	5th	0.125	0.492	0.150
7	27	Normal pregnancy, about 135 pounds	9 months	1st	0.19	0.421	0.136
8	30	Normal pregnancy, about 150 pounds	9 months	2nd	0.067	0.492	0.204
9	30	128 pounds	8 months	3rd	0.091	0.555	0.199
10	19	About 115 pounds, trace of albumin	9 months	1st	0.1108	0.555	0.204
11	22	About 150 pounds, trace of albumin	End of 8th month	1st	0.0918	0.522	0.175
12	24	Normal pregnancy, very fat	End of 8th month	1st	0.10	0.5772	0.180
13	30	Œdema of legs, trace of albumin	8 months	5th	0.091	0.568	0.185
14	22	6 ft. 2 in., weight, 192 pounds	6½ months	1st	0.078	0.5772	0.303
15	29	Very bony woman, vomited last 3 weeks	At term	1st	0.083	0.397	0.300
16	26	Very fat woman, 158 pounds	At term	1st twins	0.10	0.364	0.333
17	30	Normal pregnancy, about 120 pounds	At term	2nd	0.087	0.492	0.241
18	40	Very fat woman, vomited over two weeks before birth	At term	4th	0.108	0.541	0.264
19	34	Normal pregnancy	Postplacental blood	1st	0.110	0.522	0.250
20	22	Normal pregnancy, 136 pounds	Postplacental blood	3rd	0.077	0.541	0.180
21	21	127 pounds, normal pregnancy	During labor	1st	0.10	0.522	0.240
22	26	Normal pregnancy, about 140 pounds	Postplacental	1st	0.13	0.541	0.185
23	22	Normal pregnancy, about 140 pounds	Postplacental	1st	0.10	0.492	0.280
24	29	About 130 pounds	Postplacental	2nd, twins	0.083	0.444	0.218
25	37	Weight 168 pounds	4 days postpartum	12th	0.08	0.317	0.265
26	26	0.3 per cent sugar, 2 quarts average urine pro die	½ week postpartum	....	0.08g	0.317	0.500
27	24	Weight 121 pounds	11 days postpartum	2nd	0.10	0.555	0.280
28	24	Same as No. 8	1 week postpartum	1st	0.11	0.570	0.202
29	25	Same as No. 7	10 days postpartum	2nd	0.10	0.555	0.204
30	20	.....	3 months	3rd	0.072	0.302	0.163

the cholesterol, are outside of alimentary lipæmia remarkably constant for normal individuals. It has been found that the true fats, the glycerides of fatty acids, neutral fats in the blood, are during the time the alimentary tract is free, negligibly small, (Letschke, Kemperer). During digestion, especially after a meal rich in fats, an alimentary lipæmia is found, an addition of triglycerides to the blood, and the tri-glycerides are added directly to the blood by way of the intestinal capillaries. The presence of this suspended fat in the blood persists for some hours — 8 to 12 — and then disappears. At other times there is a mobilization of fat from normal fat deposits, which during starvation, might augment the blood fat.

So found Neuman.

	Examination 12 hours after eating	Examination 3 hours after eating
Total blood fats.....	5.46	6.26
Cholesterol.....	0.9	1.03
Cholesterol ester.....	0.5	.0.82

If we find in the blood at a time when the alimentary tract is free an increase in the blood fats, we have to deal with a lipoidæmia, an increase in the lipoids, fat-like substances, constant intracellular and extracellular constituents of the blood, which are soluble in ordinary fat solvents but are not simple fats or fatty acids. Their main representatives are cholesterol and lecthin. Under normal conditions they are found in the same percentage in the same individual or species. They show an alimentary increase as do the true fats. In the tests which I have made, I have used the blood just before breakfast,

to exclude alimentary lipæmia or lipoidæmia. In the cases where postplacental blood was taken the women had had hardly any nourishment for 10 to 15 hours.

The very rapid and decided increase in the percentage of lipoids and cholesterol in the blood after intake of food shows definitely that these substances are in some way or other absorbed by the intestines out of the food and get into the blood. But surely not all the lipoids are of this exogenous origin; some of them are undoubtedly the product of metabolism of the tissue cells. The hepatogenic origin of some of the cholesterol seems to be proved by parallelism existing between the increase in the cholesterin content of the blood and the increase in the excretion of bile acids. The fact that the different organs and their different tissue cells respectively contain lipoids characteristic of them would substantiate their own lipoid synthesis, their ability to build and consume fat and lipoids. It is believed, for instance, that the organism is able to produce phosphatides from triglycerides. Still it has been shown that animals fed on food artificially freed as much as possible of lipoids, in spite of addition of large amounts of organic phosphates, will die; they die of lack of lecthin and cholesterol. Of special interest are the cholesterol-esters, which are present in the blood serum, they are connections between cholesterin and fatty acids and could be the means of fat metabolism, of the transportation of fats, its synthesis and the excretion of fatty acids, on the one side leaning toward the acid component of the fatty acids, on the other to the lipoids; they build the link which similar connections represent such as the lipopeptides or lipoproteides, the link between lipoids and proteids. A great deal about the origin of the lipoids of the body, their resorption or assimilation, their entering into the cells or separating from them, likewise their function is mostly theory

How is this hyperlipoidæmia, hypercholesteræmia in pregnancy to be explained; what is the ultimate cause? In seeking other conditions which show hyperlipæmia, we find a similar increase or higher amounts in patients with diabetes mellitus, in patients suffering from starvation and various forms of anæmia, chronic nephritis, carcinoma, chronic alcoholism, and after prolonged anæsthesia, while in some of the infectious diseases — not pneumonia — the level of the lipoids sinks low and rapidly. The high level in alcoholism is explained through the fact that the alcohol furnishes an easier burning material than the lipoids, protecting them; in the infectious diseases, the protecting agents, which the lipoids exert, use up the lipoids. An explanation for the hyperlipæmia or lipoidæmia, lies in the assertion that we have to deal with an alimentary increase of the fatty substances. It is pointed out, that the pregnant show an increased appetite during the second half of pregnancy and that the pregnant, sometimes of their own volition, sometimes on the advice of the medical profession, increase the quantity and quality of the food taken to such an extent as to overbalance the demand of the fœtus, for many pregnant women live a quiet and easy life and do not require this increase in amount of food. But this exogenous moment does not hold true. I have in my list two patients, who suffered from frequent vomiting for 3 weeks previous to the time the specimen was taken, but their cholesterin percentage was higher than normal. Not all pregnant women show an increased appetite, many work hard until partus. It also cannot be presumed that this higher lipoidæmia is the result of an increased mobilization of the fat from the normal fat-deposits of the body to the blood. The normal adipose tissue does not contain lipoids to any extent and the subcutaneous fat in pregnancy is increased and not de creased. Impaired oxidation as an analogy to pneumonia has been enumerated as a cause, but oxidation in pregnancy is increased and not decreased.

Sagal found the lipolytic enzymes of the blood, the lipase reduced in the pregnant. In pregnancy, a condition of marked growth and energy, the lipase should be diminished, thus explaining the high level of the lipoids. But other authors doubt the existence of a direct lipase in the blood and concede only an ester-splitting ferment.

Kempner explains the hyperlipæmia in diabetes as a result of increased cell disintegration, with the consequent freeing of lipoids, especially the cholesterol, the least soluble of them; the integration of cells a necessity for the building of new cells. Similar conditions exist during pregnancy, a vast amount of lipoids, so necessary for the metabolism and such growth-stimulants as the lipoids represent, are needed for the fœtus. Furthermore the large amount of lipoids, which the fœtus extracts from the maternal organism simulate a condition in the mother such as we find in a patient suffering from chronic anæmia or carcinosis. But no definite finding substantiates this analogy. Furthermore there is nothing definitely known or observed about the ways and means of how maternal fat reaches the fœtus via the placenta; of late some investigators give to the chorionic villi the same rôle which the villi of the intestines play in the fat absorption. Quantitative estimation of the fats and lipoids of mother and fœtus gives widely different values for both, showing that there is no equilibrium between the two concerning the fatty substances.

Slemons believes that the hypercholesterol value is possibly the result of cholesterol transportation from the fœtus to the mother. Hypercholesteræmia begins with the fourth month of pregnancy at a time when fat metabolism becomes active in the fœtus. Cholesterin, according to Slemons, a waste product, should thus pass from fœtus to mother. If this is true, we should find very high values of cholesterol in twin pregnancy. In the two cases of twin pregnancy I examined the cholesterol content was not abnormally high.

Cholesterin is an antitoxic substance, it forms a protective mechanism for the body, it is able to neutralize poisons and toxins, it weakens and destroys the hæmolytic action of saponin, and shows quite especially an affinity for these toxins which are produced in the metabolic processes. Many point out these properties of the lipoids and believe their increase a necessity as a protective means for the maternal organism.

The most unconstrained explanation of the phenomenon of hyperlipoidæmia in pregnancy can be found in the changes of the internal glands during pregnancy. Under normal conditions the adrenalin glands, the thyroid, the hypophysis, and the ovaries, and other internal organs have a regulating influence upon metabolism. Their connection with the generative system is proved by the constant finding of the hypertrophic and hyperplastic conditions and by their histological changes during gestation.

If we regard the ovary as of first importance, we must consider some work done by Herrman and Neumann, who found hyperlipoidæmia as a constant condition shortly after castration, and shortly after cessation of menstruation or cessation of the function of the corpus luteum. They found the same to be true in cases of amenorrhœa through chlorosis — hypofunction of the ovary. Lindeman made the same observation and found especially the cholesterol esters increased. With the loss or hypofunction of the ovary a distinct decrease in the catabolism of the organism takes place (Loemy, Richter); we find that castration disposes in at least 50 per cent of the cases to adiposity. Of course it must be mentioned that this obesity appears in only about 50 per cent of the cases and that the hyperlipæmia following castration is temporary only, gradually disappearing; while in pregnancy it gradually increases. Therefore, we must direct our attention to some other stimulants, which are easily found in the other endocrine glands. All glands of internal secretion possess qualities similar in their influence upon the metabolism. This explains how one can easily substitute one for the other; it explains the interaction between the glands. By the action of hormones from the ovary there may exist an interaction between liver and ovary; and corpus luteum.

Injection of the watery extract of corpus luteum (P. D. & C.) into the blood produces rapidly a temporary hypercholesteræmia. The same result is obtained from adrenalin injection. How much the other endocrine glands interact during pregnancy is not definitely known, but the physiologic hypertrophy of the hypophysis and thyroid, and the constant and enormous increase in the chro-

maffine cells during pregnancy, point out their close relation to the increase in fats and lipoids during gestation. The increase in the adrenalin glands during pregnancy of the cholesterol content and its esters is by some investigators believed to be great enough to explain the phenomenon of hypercholesteræmia, but Biedel has pointed out that this cannot be true, as cholesterin-karaubat, the main representative of the cholesterin ester in the adrenalin, is not present in the blood. These last mentioned findings surely point to the close relationship between changes in the maternal blood and the physiologic changes in the glands of internal secretion. Still the ultimate cause of hyperlipoidæmia has yet to be found. The fact remains that pregnancy is the greatest factor, for the internal glands play only an indirect part. Kiutsi seeks the final cause in the syncytium and believes that substances produced in the placenta, especially the nucleinic acids, enter the maternal blood and produce all the changes, reactions and hyperfunctions, with the resulting hyperlipæmia or lipoidæmia. Lindeman, on the other hand, says: "The fœtus is like a parasite, it takes up valuable material from the mother's blood, and she is in a condition similar to the diabetic who loses sugar, or the nephritic who loses albumin. For its existence, and for its growth the fœtus is entirely dependent upon the mother, and it produces in the organism of the mother a rapid mobilization of lipoids; therefore we find the lipoids increased in the mother's blood and steadily increasing in the latter months of pregnancy with the increased demand."

Fatty acids in the blood of six normal women according to Bloor.		Cholesterol in the blood of six normal women according to Bloor.	
0.345	0.260	0.195	0.184
0.300	0.313	0.177	0.208
0.300	0.263	0.197	0.205

It can readily be seen if we compare the normal findings with those of the pregnant, that in pregnancy there is a true hyperlipæmia and hypercholesteræmia. Since there is a constant parallelism between the increase of the cholesterol and cholesterol esters and lecithin, we can easily figure out that the increase of the total fatty substances lies on the side of the lipoids.

The low cholesterol reading in some of my cases does not mean an absolute low cholesterol content of the blood in these women. Different investigators find the cholesterol content of the blood to vary in the normal from 0.11 to 0.2. It is possible that the cases of my group with a rather low cholesterol content are the ones who have normally a low cholesterol content around 0.1 or 0.12, and figures as low as 0.17 would mean a decided increase.

CONCLUSION

1. There is no hyperglycæmia in the later months of pregnancy or in the first two weeks after pregnancy.
2. Glycosuria and alimentary glycosuria during this period can be explained by the activity of the glands of internal secretion or as a renal hyperfunction.
3. Hyperlipæmia in pregnancy is in reality for the most part a hyperlipoidæmia.
4. There is no parallelism between cholesteræmia and hyperglycæmia in pregnancy.
5. The etiology of this condition is as yet not established.
6. It seems that the endocrine glands are to be looked upon as an important factor.

I wish to express my thanks to Joseph De Lee for permitting me to use the material of the Lying-In Hospital, also my thanks to Withrow Morse, Professor of Physiological Chemistry of the University of West Virginia and to Miss L. Langenberger, chemist of the Nelson Morris Institute for Medical Research, for their most valuable assistance.

THE TECHNIQUE OF GALL-BLADDER AND COMMON-DUCT SURGERY

By H. M. RICHTER, M.D., F.A.C.S., Chicago

THE technique of gall-tract surgery is in process of becoming standardized. It is still in the course of its development as evidenced by the very material variation in the operation as described by the various contributors to the subject. Some underlying principles involved seem rather frequently to be overlooked, hence the following rather short contribution. As we are interested in but a few phases of the technique, we shall not consider the operation as a whole, but only those points that we wish especially to emphasize.

Enucleation of the gall-bladder. Most writers seem agreed that the cystic duct should be isolated before division to insure the safety of the common duct. But, as in recent years, a larger proportion of acutely distended gall-bladders are removed rather than drained, it is frequently found that the cystic duct is not easily reached without the preliminary emptying of the gall-bladder. Particularly is this true where the preliminary rotation of the liver is not readily or perfectly accomplished. The tense gall-bladder pushes the cystic duct backward and upward, away from the operator, since the fundus is fixed to the liver and the apex is the only mobile part and must, therefore, be the most disturbed part. It will be found that a tense gall-bladder will lift itself out of the incision into the operator's hand if it is first released from the liver. This is accomplished by splitting the peritoneum as it is reflected from the liver on to the gall-bladder, just enough to admit a finger. The finger is inserted and the gall-bladder peeled out of its bed. In the course of its enucleation more of the peritoneum may require cutting, although most of it will readily tear. The release of a tense gall-bladder in this way will cause the fundus, as stated above, to push its way out of the incision almost into one's hand and bring its apex measurably within control. In this way the cystic duct is mobilized and made easily accessible. It is a fact that peeling out the gall-bladder in the opposite direction—from the apex toward the fundus—is somewhat cleaner, since the vessels are caught before their branches are torn; but this is a matter of but a moment's time, and the loss of blood will usually be trifling if the plane of cleavage between gall-bladder and liver is not lost.

The cystic duct. The cystic duct should, I believe, rarely be clamped with its vessels, tissues, and peritoneum *in toto*. It is much cleaner technique to break or split the overlying peritoneum and clamp it after having isolated it. It is quite unnecessary to ligate it close to the common duct; one must avoid the careless ligature of the apex of the gall-bladder itself, lest a continued infection of the stub of the gall-bladder remain, a danger to which C. H. Mayo and others have called attention.

It is an odd fact that many writers insist upon severing the cystic duct close to its termination in the common duct. Their suggestion is based mainly upon the well-known fact that the stump of the cystic duct tends to enlarge after removal of the gall-bladder, and they assume this to be objectionable. But the cystic duct is probably as rarely the site of origin of stones as are the other ducts. Stones have been left behind in the cystic duct, but that should be charged to careless technique. The very absence of any number of reports on recurrence of trouble in the stump of the cystic duct other than that due to stones left behind, should suggest that it is rarely the source of trouble. Hans Kehr reports having removed *one* such duct that had attained a length of 10 centimeters, but fails to state the reason for its removal. The other cases have reference entirely to stones that have been left behind.

The flaps of peritoneum. In peeling out the gall-bladder the finger naturally finds the plane of cleavage and with little care the liver substance is not torn; on each side part of the peritoneum is peeled off the gall-

bladder, to be left behind to cover in the denuded liver. But these peritoneal flaps are of minor importance and *should not be sutured over the denuded liver*, merely pressed against it. In this way the flaps will adhere as a Thiersch graft. Suturing tends to lift the flaps out of their depressed bed, leaving a space behind, and adds a needless step to the operation

Peritonealization is a fetish that calls for many an extra half hour of worship, when the surgeon might better be employed in closing the abdomen.

The raw surface. The denuded surface of the liver is partially covered as suggested above; but this step in the technique is of but slight importance. The position of the raw surface is such that massive adhesions to it are naturally objectionable, but the surface itself is depressed, and not exposed to contact with adjacent structures, and adhesions would be minimal were it not for other factors scarcely affected by drawing the peritoneal flaps across. The gauze pack is a much more potent cause of adhesion than the raw surface *per se*. A satisfactory method, too, of minimizing adhesions is that suggested by E. Wyllys Andrews of dropping the omentum in between the liver and the duodenum. It is rather the oozing from this surface that may be important, and possibly to some extent, the leakage of bile from the torn surface. The treatment of the flaps suggested above is by far the best means of taking care of this. Oozing from the liver surface may be sufficient to make closure unsafe, though this is exceptional. The use of one of the newer hæmostatic preparations on the order of "coagulose" may prove valuable; my experience with the powder, dusted on the liver, thyroid, and brains surfaces, has been satisfactory. Packing may sometimes be avoided in this way.

Bile leakage from the liver surface may be a factor in producing an otherwise unaccountable postoperative reaction.

The treatment of the ligated stump. Though many operators close the abdomen without drainage, it is almost universally suggested that drainage should be instituted after cholecystectomy apparently without considering the advisability of closure without drainage. An exception is in the paper of A. Murat Willis[1], who reports a series of thirty-eight cholecystectomies without drainage, with one death. But he makes the peculiar basic error of excluding his stump from the peritoneum.

The end of the stump may fairly be regarded as infected usually in the mildest degree. The peritoneum is quite well able to care for this infection. Willis' cases show that even if buried outside of the peritoneum, where the tissues are least able to care for infection, no harm is done; but this stump should be left free in the peritoneum. It is crushed, which thins it out, leaving but a minimum of mucosa behind, ligated with a very moderate sized catgut (No. 0 or No. 1) and then just left alone. In our first cases we touched up the stump with iodine or carbolic acid, a needless rite.

The abdomen is now closed without drainage.

While this paper was intended primarily to discuss the technique of cholecystectomy, particularly with reference to the closure of the abdomen without drainage, I wish to add a word regarding the similar closure of the abdomen after opening the ducts. Provided no obstructive lesion is left behind, it is illogical to drain the common duct or leave a tube in it following choledochotomy. With the duct free of obstruction, the distal orifice in particular being open, the normal drainage into the duodenum is superior to the usual methods in vogue.

Here, as in cholecystectomy, the absence of the reaction and infection about a gauze pack or other form of drainage results in a much smoother convalescence, with fewer postoperative adhesions to leave a trail of late sequelæ. Kehr stated some years ago that Koerte and he had given up immediate suture of the duct because of the danger of obstruction, but leave a tube in the duct for 10 to 12 days, and this is the usual procedure. Primary suture of the common duct is, of course, no new idea. It has, however, repeatedly failed, and drainage is regarded as the keynote of safety. But the common duct

[1]Willis, A. Murat. J. Am. M. Ass., 1917, lxix, 1943.

has a peritoneal covering on the exposed surface through which the incision is made, and if the operative work has been complete, it is as illogical to drain this line of suture as a similar line of suture in stomach or intestine.

It is an essential requirement in carrying out immediate suture that the common duct should be patent; that no stone in the ampulla, no partial closure of its orifice from a thickened muscle of Oddi, or chronic pancreatitis, should be present. If a good sized sound or scoop cannot freely be passed down the common duct into the bowel, a duodenotomy should be made to investigate the orifice direct; or the orifice should be slit up or stretched if required. It is here, I believe, that even the skillful surgeon has often erred and has found it necessary to improvise external drainage to compensate for his failure to convert the common duct into the best possible drainage tube and drain the tube in the best possible place, the duodenum.

In my service at the Wesley Memorial and Cook County Hospitals, I have carried out the idea of closure of the abdomen without drainage in all gall-bladder removals or common-duct operations, except where unusual oozing from the liver surface made a gauze pack seem necessary, or where the apparent virulence of an acute infection made me fear a fulminant peritonitis. The number of cases has not been large, but there has been no death in the series. The postoperative recovery has usually been smooth, "like an uncomplicated appendix case," to use the expression of one of the house surgeons. A few cases have shown a reaction suggestive of what is commonly seen in patients in whom a gauze pack has been used. It has seemed to me that the leakage of infected bile from the denuded liver surface might possibly be a factor in the production of this reaction. It has not been necessary to reopen the abdomen in any case. No patient has developed an unusual temperature. The abdominal incision in all cases has remained clean.

GANGRENOUS APPENDICITIS COINCIDENT WITH LABOR

An Unusual Case of the Initial Attack Occurring in, and Operated Upon, During the First Stage of Full-Term Labor in a Primipara. Delivery. Recovery[1]

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IT was the intention of the writer to render a report of this rare coincidence by incorporating the case report in a review of the literature on acute appendicitis complicating labor. To my great surprise a perusal of the *Indices Medicis* for the past ten years under the headings "Surgery of the Appendix" and "Complicated Labor" did not result in the finding of a report of a single case of appendicitis operated upon during the active process of labor.

The following facts add to the rarity of the case: (1) the patient was a primipara; (2) she had never had an attack of appendicitis or any type of abdominal pain up to the time of the event; (3) she had had a perfectly normal gestation course, promising nothing unusual.

Williams, of Baltimore, in his textbook, mentions two cases which he saw in consultation but has had no case in his own practice. Hirst, of Philadelphia, in his extensive paper on "The Diagnosis, Treatment and Management of Surgical Conditions Complicating Pregnancy," does not cite any instance of appendicitis coincident with full-term labor. Hirst's textbook (various editions) does not mention any specific case of an initial attack of appendicitis complicating labor. Cragin's textbook does not mention any

[1]From the Surgical Service of the United States Military Academy.

definite instance of similar circumstances. DeLee and the *American Textbook of Obstetrics* were searched with no better result.

The writer desires to place on record the case about to be described, first, because of the extreme rarity of acute gangrenous appendicitis with beginning peritonitis, coincident with full-term labor; second, because the attack of appendicitis was the patient's first attack—she denies emphatically ever having had abdominal pain at any time during her life; third, because of the stormy and eventful postoperative course; fourth, because of the eventually satisfactory and complete recovery.

Mrs. H. S., age 22, married 9 months; of exceptional intelligence, good health and habits. The family history, having no bearing upon the condition at hand, may be considered negative. The personal history represents an exceptionally healthy existence. Aside from the milder diseases of childhood, the only condition for which she had consulted a doctor, was the rather common one of frequency of urination in the early months of gestation. This symptom had disappeared before she came under my observation.

Prepartum examinations. The patient came for her first examination on June 1, 1918. She had no complaints whatsoever. The general examination showed a vigorous young woman of thin, wiry build. The heart, lungs, head, neck, and extremities were negative. Bimanual and abdominal palpation defined a vertex position with small parts to the right, back and heart sounds to the left. Mammary glands moderately enlarged with a serous secretion from the nipples. Bowels and urination normal. Urinalysis, negative. Complete bimanual and abdominal examinations repeated every two weeks to within one week of term, revealed no abnormal physical condition. Aside from the ordinary discomfort due to the activity of the fœtus, the patient never experienced any abdominal pain at any time. Weekly examinations of the urine were consistently negative.

All the obtainable data served but to emphasize the unusually uneventful course of gestation.

Calculations, based upon (1) the probable date of conception (October 27, 1917), (2) the first day of the last menstruation, and (3) the descent of the uterus in the thirty-eighth week, indicated that the expectant date would lie between July 15 and 20.

Diagnosis of appendicitis. At 1:00 a.m. on July 15, I was called by telephone to suggest something to relieve epigastric distress, which had started earlier in the evening and had increased toward midnight. Slight nausea accompanied the distress but no pain anywhere. Alkalis and carminatives did not relieve the distress. Gastric lavage and an enema were given at 8:30 a.m. and relief followed and lasted throughout the day and evening of the 15th and the morning of the 16th. At 3:00 p.m. on the 16th the nurse reported a temperature of 99.2°. This was the first rise since the trouble began. At 8:00 p.m. the temperature reached 101°. There had been no labor pains and no abdominal pain during the period of temperature *up to this point.*

At 7:00 a.m. on the 17th the temperature was 100.4° and the palpation revealed, *for the first time*, abdominal tenderness favoring the right iliac and lumbar regions, maximal at a point 1.5 inches above the anterior superior spine. Tenderness could also be elicited in lesser degree in the left iliac region.

The antecedent history gave no aid in making the decision as the patient had had no pain of any kind in her abdomen as far back as she could recall. The point of maximum tenderness was high and external to McBurney's point, but allowance was made for the upward displacement of the intestines by the full-term uterus and a diagnosis of acute appendicitis was made. To add to the difficulty of reaching this alarming conclusion (which conclusion all parties concerned, including the writer, were loath to admit), the patient began to complain of infrequent and irregular, but nevertheless definite girdle pains, beginning in the "small of the back" and migrating forward and downward to the hypogastrium. Examination revealed a beginning dilatation of the cervix.

The difficulty of convincing oneself of the real state of affairs in a diagnostic dilemma of this kind can scarcely be exaggerated; to say nothing of forcing the acceptance of such a conclusion upon a couple married less than a year and neither of whom had experienced any illness prior to this. However, both the husband and wife acted wonderfully well under the circumstances and agreed upon a consultation and immediate operation if the consultants concurred in the opinion.

Consultation. Lieut. Col. Wm. H. Haskin, Post Surgeon, examined the patient at 8:30 p.m. and agreed with the diagnosis. Major Charles Townsend of the New York State Guard, on duty at Newburgh, New York, was asked to see the case. While waiting for Dr. Townsend the patient was removed to the hospital and preparations were made for all possible exigencies, both operative and obstetrical. Difficulties in transportation between Newburgh and West Point delayed the second consultation until 11:00 p.m. Dr. Townsend also concurred in the diagnosis and kindly consented to assist at the operation.

Operation. The operation was begun at 11:50 p.m. (July 17, 1918) and ended at 12:30 a.m., July 18. Chloroform anæsthesia was administered by Colonel Haskin. The gravid uterus, occupying the entire anterior aspect of the abdomen necessitated a high and extremely lateral incision. An oblique incision, four inches long, was made, beginning in the flank at a point one inch above the iliac crest and extending downward and parallel to Poupart's liga

ment to a point one inch below and mesial to the anterior superior spine. The lumbar and abdominal muscles were divided bluntly and retracted giving an exposure of peritoneum very similar to the exposure sought in removing a calculus from the middle third of the right ureter, the peritoneum in this instance being opened instead of being retracted mesially. Division of the peritoneum resulted in a gush of several ounces of fluid of a slightly turbid character. The fluid was evidently of general distribution. The gravid uterus seemed to occupy all the available space. A pad was placed over it and it was held to the left, while the operator inserted his hand upward toward the gall-bladder region in an attempt to locate the upwardly displaced cæcum. A tense, fluctuant sausage-shaped mass was located in the same region. The cæcum was pinched between the index and middle fingers, while the fusiform mass attached to it was allowed to rest in the palm of the hand. Traction downward was exerted then, with great care, upon the cæcum. When delivered into the wound, the mass proved to be a completely gangrenous appendix distended with fluid, but luckily, as yet, unperforated. The proximal half-inch was still firm enough to ligate, and, after being crushed with a clamp, was tied with No. 3 plain catgut. A scalpel dipped in pure phenol was used to divide the appendix between the ligature and the clamp, thus carbolizing the stump and the open end of the appendix at one time. The amputated organ was removed without accident. No attempt at inversion or burying of the stump was made. A rubber tube drain, ⅜-inch bore, was led from the site of the appendix, and another from the right pelvis, to the center of the wound. There was no localized exudate to drain either above or in the right pelvis. The peritoneum was closed with No. 3 plain catgut, continuous suture, the drainage tube exit being made at the lower central part of the wound. The muscles were closed with No. 2 plain catgut, interrupted mattress sutures, the fascia with No. 3 plain and No. 3 chromic alternating mattress sutures. Through-and-through sutures of double silkworm gut were passed through the skin, fasciæ, and muscles, and tied over gauze rolls above and below the exit of the drainage tube, to insure firm pressure along the entire length of the wound.

The details of the closure are given because it was considered of prime importance in view of the impending labor with its resultant strain on the abdominal musculature.

The appendix was fusiform in shape, dull on the peritoneal surface; the coats thinned by distention, and the lumen containing about two drams of foul, sanguinous pus. The organ was in the preperforative stage of gangrene, the muscular coats being in a state of dissolution. The slightest pressure with a scissors at the center of the distended organ was sufficient to cause it to scatter its contents over the specimen basin, demonstrating the tension within. A coprolith was found at its proximal end. There was no omentum adherent to the surface.

The patient returned from the operating room in excellent condition and reacted from the chloroform anæsthesia without vomiting. One-half hour after regaining consciousness the patient complained again of girdle pains starting in the back and radiating forward and downward. The intervals were 15 minutes with regularity. One-eighth and one-sixth grain doses of morphine sulphate hypodermatically had been given five hours and fifteen minutes respectively, before operation. Another dose of one-eighth grain was given two hours after the patient returned from the operating room, and she slept from 3:00 a.m. to 4:00 a.m., when the nurse reported a gush of fluid following a severe bearing-down pain.

Second stage of labor. Inspection revealed ruptured membranes with the caput appearing with each pain. The pains were then occurring at ten-minute intervals with regularity and increased severity. The pains were not causing any undue discomfort in the wound. Complete dilatation was effected at 9:00 a.m. The patient's bed was removed to the operating room and the obstetrical instruments and lung-motor were kept in readiness.

Delivery. The patient was allowed 45 minutes to deliver the head. At the end of this period she complained of pain in the wound, and because of the recent operation, nine hours before, we agreed to give her a second chloroform anæsthesia, and assist with low forceps application. The head was delivered under partial narcosis, the shoulders and small parts following easily. No laceration, except a slight mucous separation about three-quarters inch long, was found. This did not require suture.

Third stage of labor. The placenta was delivered with membranes complete, 35 minutes after the completion of the second stage, and the uterus contracted normally and without hæmorrhage. One-fifth grain of ergotin was administered hypodermatically, and attention was directed to overcoming the apnœa of the baby.

The baby. The usual manual and hydrotherapeutic measures were used for 10 minutes, during which time the pulse remained regular and of good quality. A few spontaneous respirations occurred during this period, but cessation of our activities resulted in cessation of the respiration. The lung-motor in conjunction with oxygen was applied. The cyanosis diminished, and, after 35 minutes of intermittent use of this appliance, the respirations continued spontaneously and the baby emitted lusty cries. There were no forceps marks and no paralysis of the face or extremities. The heart sounds were normal. The weight was 8 pounds, 1 ounce.

As far as could be determined we had delivered a full-term baby, who had given us a little unusual trouble in establishing normal respiration. However, at 12:45 p. m., two and a half hours after the delivery, the nurse reported cyanosis and apnœa with heart action regular. The lung-motor was reapplied and after 20 minutes respirations re-

established themselves and the baby seemed as well as before. Lusty cries and muscular activities were indulged in and no further trouble seemed imminent. At 3:30 p.m. a second recurrence of apnœa was reported. It required 1 hour and 5 minutes of artificial respiration this time, and things were as before. The heart maintained its regular action throughout. At 5:00 p.m. a fourth attack of apnœa started. All means failed us this time. The heart became irregular, and the baby ceased to breathe at 5:20 p.m.

Cause of death of the baby. We catheterized the baby and examined the urine for traces of morphine, thinking perhaps that the three doses administered to the mother before and after the appendectomy, might have affected the respiratory center of the fœtus. No evidence of the drug was found by the toxicologic analyses. As the child lived seven and a half hours after delivery and seemed perfectly normal between the attacks of apnœa, with no evidence of facial or limb paralysis, we felt justified in eliminating forceps injury as a cause. There were no marks on the child's head as the manipulation was gentle and of short duration, as evidenced by the absence of perineal laceration, although the mother was a primipara.

The most reasonable explanation seemed a toxæmia derived from the mother as a result of the acute purulent (empyema) appendicitis. This decision seemed supported by the postoperative course of the mother, about to be described. Postmortem examination of the child was refused.

The mother. The mother returned from the operating room in excellent condition, having had the usual postpartum chill. The first postpartum (and postoperative) day was spent uneventfully, slight nausea and inability to void urine being the only complaints. Fluids were taken in small quantities for thirst. Four hundred cubic centimeters of urine were obtained per catheter at 8:30 p.m.

Codeine sulphate, 1 grain, was given at 10:10 p.m. This carried the patient through until 2:10 a.m., when she awoke and vomited a large amount of mucous and bile-stained fluid. At 4:00 a.m. of the second day, 330 cubic centimeters of urine were obtained per catheter. A second 1 grain dose of codeine was given at 4:30 a.m. The patient slept until 9:00 a.m.

At 9:15 a.m. the nurse reported a noticeable irregularity of the pulse. Digitalin, 1 milligram, intravenously, was given and a continuous Murphy drip started to control the thirst.

No symptoms of internal bleeding were in evidence. The pulse again lapsed into an irregular and rapid rate (at first 140 and accelerating to 160).

Hypodermoclysis was started and after 250 cubic centimeters had been given the pulse had become imperceptible and an intravenous of saline was started without delay. No response was obtained until 400 cubic centimeters had been given and 2 milligrams of digitalin with 10 minims of adrenalin added through the intravenous tubing.

At this point the pulse became palpable and as the intravenous continued the pulse improved in quality, rate, and rhythm. Six hundred cubic centimeters in all were given. The consciousness returned.

One hour later morphine sulphate 1/6 grain and atrophine sulphate 1/150 grain were given for restlessness. An eighth of morphine with 1/30 of strychnine were given at 11:15 a.m., and at 1:25 p.m. a stimulating enema of hot coffee, 2 ounces, whisky, 1 ounce, and saline, 2 ounces, was given.

Catheterization after 9 hours returned only 275 cubic centimeters of urine in spite of the Murphy drip and the intravenous. Boiling of the acidified specimen showed a solidification of 25 per cent by volume of albumin.

The cardiac collapse and the repression of urine, with marked albuminuria in the mother convinced us that the death of the baby had been from toxic causes derived from the mother. The cardiac failure was evidently a toxic myocarditis due to retention of toxins as a result of the suppressed eliminative function of the kidneys, which organs were in turn suffering from the toxins.

The critical state of the patient was discussed in consultation with Dr. Frank S. Mathews, of New York, and Dr. Townsend, of Newburgh. The wound was examined and found innocent as a cause of the trouble. The discharge was serosanguinous and without odor or any suggestion of purulent material. The pelvic drainage tube was removed at the suggestion of Dr. Mathews. Forcing of fluids, hypodermoclysis, Murphy drip, and constant heat applied by an electric pad to the lumbar region, were agreed upon as the best means of retaining and increasing the function of the kidneys.

The first nine hours of continuous Murphy drip showed a retention of 950 cubic centimeters. During the fifteen hours, from 9:15 a.m. to midnight, 510 cubic centimeters of urine were obtained at two catheterizations of 250 and 260 cubic centimeters each. The 25 per cent volume precipitate of albumin had reduced to about 10 per cent volume.

At 4:15 a.m. (this of the third day postoperative) the heart showed signs of repeating its performance of the previous morning and the following measures were resorted to: (1) digitalin, 1 milligram intravenously; (2) caffeine sodium benzoate, 1 grain intramuscularly; (3) repetition of digitalin and caffeine, 1 hour and 15 minutes later for persistence of irregularity of the pulse and a rate of 160; (4) strychnine sulphate, 1/30 grain two hours after the first medication for tonic effect. As a result, the irregularity of the pulse disappeared. The quality improved but a dicrotic character persisted for 9 hours.

From midnight to 2:00 p.m. of the third day, 325 cubic centimeters of urine were obtained by catheter, 450 cubic centimeters of the Murphy drip were retained in the 24 hours. The saline was changed to 5 per cent glucose for nutritional purposes, the whisky being increased from 30 cubic centimeters to 45 cubic centimeters per 1000 cubic centimeters.

Fluid by mouth was increased, and varied to stimulate appetite, 1 ounce every hour of either albumin water, champagne or cracked ice being given. Codeine sulphate in 1 grain doses was used every 4 hours or more as indicated. In the 8 hours from 2:30 to 10:00 p.m., 500 cubic centimeters of urine were obtained by catheter. Just a deep cloud of albumin remained.

This was a real improvement in the quality and quantity of the kidney output. The fluid intake was pushed, and the electric heat to the lumbar region was continued. Continuous improvement followed from day to day under stimulation as indicated and forced feeding. On the fourth day the remaining drainage tube was replaced by a No. 20 French catheter, as the discharge had almost stopped.

On the fifth day the temperature rose to 101° and later to 102°. This was reduced by enemata. A slight icterus which appeared with this temperature rise disappeared in 2 days. Nothing was found in the wound or vicinity to account for the temperature so the catheter was removed from the wound on the eleventh day.

On the sixteenth day postoperative, the patient was removed from the hospital to her quarters. On the second day at home the temperature rose to 104°. This continued two days. No local complaints were registered. Vaginal examination revealed nothing and there was no pain in the wound. On the twenty-second day the patient complained for the first time of pain along the crest of the ilium to the outer side of the wound. An anæsthetic was given and the remains of the drainage point of the wound was opened by stretching with graduated metal urethral sounds until the index finger could be inserted. A boggy, sanguinous exudate, devoid of visible pus, was found to the outer side of the wound. It corresponded to the muscular layer, and the peritoneum seemed firm and healed. The exudate was broken up with a sweep of the finger and a rubber tube inserted. The temperature dropped and remained normal after three days. The tube was removed and the patient allowed to walk about the house. The wound healed and except for a slight superficial abscess, opened a week later, while I was on leave, by Colonel Haskin, the patient had no further trouble.

A final vaginal examination revealed a uterus normal in size, fully involuted and free to be moved in all directions. There was no residual pelvic exudate of any kind or location, which seems most unusual considering the conditions of the drainage. The breasts gave no trouble of any kind at any stage after the birth, and save for the daily application of boric acid-alcohol solution, had no special attention.

SUMMARY

1. A young, vigorous woman, a primipara, with a negative history, normal obstetrical outlook and no complaints.

2. The simultaneous occurrence of early labor pains with abdominal symptons, ending in the diagnosis and operation for appendicitis.

3. The removal of a totally gangrenous appendix, filled with pus and about to perforate. A beginning peritonitis of a seropurulent character.

4. The delivery of a normally formed and developed full-term baby and placenta. A state of apnœa in the baby lasting 45 minutes, with good pulse, followed by a normal period of 3 hours. The recurrences of the apnœa with normal periods between, finally ending in failure of the baby's heart action and death, seven and a half hours after delivery. The apnœa was probably toxic from the pus in the mother's appendix.

5. Almost fatal postoperative complications of the mother, i.e., her cardiac and renal failure, almost of fatal termination and undoubtedly of toxic origin from the appendix. A subsequent jaundice, an evidence of the effect of the toxæmia upon the liver function.

6. Complete recovery without residual pelvic exudate and with cardiac, renal or other residue of the complications and without invalidism of any kind.

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PROGNOSIS IN HYPERTHYROIDISM

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THE term exophthalmic goiter has generally given way to that of hyperthyroidism or thyrotoxicosis since careful study has shown that exophthalmos is usually absent and the goiter may be. The only essential feature in the pathogenesis is that a toxic product, or an excess of a normal one, is produced. All my cases that have come to operation have shown evidence of organic or tinctorial change in the gland which would seem to indicate that the product is always abnormal. In many of these glands a portion may be normal and if a thorough examination is not made the abnormal portion may be overlooked. The most obvious changes are frequently tinctorial but nearly always there is in addition evidence of a more permanent change as manifested by round-celled infiltration or changes in cell type or of proliferation of parenchymatous cells.

There is reason for believing that the tinctorial changes in the colloid are exhaustion phenomena due to overstimulation continued for prolonged periods. This statement seems warranted, for we are familiar with parallel phenomena in other tissues. If this hypothesis is correct the prompt relief sometimes obtained from rest and sedative treatment is easily understood.

Whatever may be the significance of the various cell changes there can be no doubt that when cells have so far departed from their normal morphology they are no longer capable of producing a normal secretion. When a gland has undergone such extensive changes, obviously the control of those factors which were responsible for the initial changes cannot be expected to produce a prompt subsidence of symptoms.

We do not know the nature of the changes in the secretion, but if it is the purpose of the thyroid to produce iodine, then certainly the gland is in a "hypo" rather than in a "hyper" state, for only a small proportion of iodine is found in the pathological as compared with the normal gland.

As a very general proposition hyperthyroidism may be regarded as a self-limited disease. The manner in which the self-limitation is reached must vary according to the anatomic state in which they find themselves when regression begins. A subsidence of the dominant features of the disease may not presage a return to the normal state. Most likely it is merely a spontaneous obliteration of the pathological process. Certain types, it can well be understood, may arrive at a state of remission with vastly less change than others. In those cases which are followed by myxœdema there is a spontaneous obliteration of the entire gland. Cases are observed in which there is a curious intermixture of symptoms, partly hyperthyroidism, partly myxœdematous. This bears out, what can be easily proved by sections, the fact that some part of the gland may show proliferative while another shows pronounced regressive changes. Either of these may be associated with portions of normal gland. In such cases a spontaneous or operative elimination of the diseased part would allow the remaining unaffected portion to carry on the function in a normal manner. In those cases which recover clinically only to be followed subsequently by a relapse, it is usually some other portion of the gland previously unchanged which enlarges.

That the thyroid is not equally affected has been almost wholly overlooked by surgeons. This is unfortunate, for it is only when the part of the gland that is diseased is removed, leaving the normal part, that the surgeon can be said to have cured his patient. Careful attention must be paid to this phase before he decides on the plan of the operation. Gland in hand the surgeon should be able to say which is the diseased and which is the normal part of the gland.

In order to appreciate the degree of recovery possible spontaneously, one must follow the patient for many years. I am able to determine that those cases which I saw in my

earlier practice have nearly all of them recovered or at least they cease to suffer from pronounced thyrotoxic symptoms. However, while most of them at least consider themselves well there is not lacking evidence of an unbalanced somatic system. They continue to be sensitive to certain nerve stimuli or react quickly to certain kinds of physical exertion. Whether these are to be ascribed to thyroid or cardiac degeneration is another matter. Some of these have so suffered from a succession of relapses that likely there is no wholly normal gland left. Some obviously have a myocardium that is efficient only for a limited degree of exertion. Some still suffer from some other disease which antedated the primary thyroid disease and in not a few all these are complicated or overshadowed by a hereditary neurotic or neuropathic state. It is clear that in order to determine the subsequent state of our ex-patients we must examine them ourselves. A written communication from them stating that they are "well" is of limited importance.

As in other self-limiting diseases our efforts must look, therefore, to the shortening of the process and in preventing a recurrence. Like appendicitis, hyperthyroidism in running its cycle is subject to certain complications and accidents which must be taken into account. The fundamental factor in the treatment must balance itself against this tendency to complications. Though far simpler and more easily comprehended, appendicitis has not yet reached a state where the universal understanding makes the treatment in all cases less deadly than the disease. This is vastly more apparent in the management of hyperthyroidism. In the first place, the life cycle of the disease is not generally understood, particularly as relates to other diseases; and the difficulties and responsibilities attending surgical treatment are seldom appreciated until experience has forced them home. If spontaneous recoveries are not complete, operative recoveries in certain cases are no better. This is at least true to the degree that the surgeon may feel that he is not derelict if he hesitates to operate upon all his cases of hyperthyroidism. On the contrary he is open to censure unless he carefully weighs all factors before deciding upon any kind of operative treatment.

The following discussion is based on my own material. The purpose primarily is to determine how constantly one can predict the revelations of the laboratory from clinical examination. If this can be attained it may be possible to separate those who do not need operation and those who will not be helped by one from those we consign to operation. The case histories are given of such as will illustrate some point vital to the discussion.

In order to reach a clinical classification each patient will be considered as belonging to one of the following categories: (1) those that recover without operation; (2) those that will most likely be cured by operation; (3) those which operation would not cure but will benefit; (4) those not benefited at all by operation or in which operation is too dangerous. These are the questions the surgeon must consider before recommending operation.

In order to facilitate this discussion I shall divide the cases into several groups according to the following outline, together with suggestions as to subgrouping which it seems important to note in some instances.

I. Adolescent:
   a. Stable nervous system without other lesion;
   b. Stable nerous system with other lesion;
   c. Neurotic.
II. Adult type:
   a. Normal nervous state without associated disease;
   b. Normal nervous state with associated disease;
   c. Abnormal nervous state.
III. Typical exophthalmic goiters:
   a. With associated lesions;
   b. Without associated lesions;
   c. Localized changes in the gland.
IV. Secondary:
   a. With associated lesions;
   b. Without associated lesions;
   c. With pronounced myocardial changes.
V. Atypical:
   a. Acute classical hyperthyroidism.
   b. Acute masked hyperthyroidism.

I. *The adolescent type.* This group must be subdivided according to their physical state and the circumstances of their origin. The essential feature is the age of onset. Usually the patient is from 15 to 25 years of age.

a. The simplest group shows evidence of intoxication after having had an innocent goiter for a period of years. The symptoms are quite parallel to those which follow the excessive absorption of the dried thyroid extract. Sometimes the symptoms of intoxication are slight. This is particularly true in girls otherwise healthy. In the former type the lessening of the labors, interdicting music and dancing for a few months for instance, together with mild sedative treatment usually produces the desired results. Some of these cases develop while simple adolescent goiter is being treated with iodine or thyroid extract. In such cases this line of treatment must be suspended and sedative treatment substituted. Those with pronounced dysmenorrhœa often are rebellious to any treatment. Hydrastis and iron help somewhat. Operation on either the thyroid or pelvic organs only serves to get both surgeon and patient more deeply in the mire. In some of these cases small doses of thyroid extract help both the dysmenorrhœa and the thyroidism. The dose must be small and the results carefully observed. The glandular enlargement in this type is usually moderate in degree but it is bilateral. In those cases in which there is a localized enlargement, particularly if encapsulated, the results of operation are immediate and brilliant.

In this type there are few anatomic changes save a vesiculation of the colloid mass with perhaps a lessening of the basophilic characters of its colloid content. In some the cells surrounding the acini may show evidence of loosening and some show round-cell infiltration and some adenoid proliferation, particularly in the encapsulated forms.

CASE 1. School teacher, age 23. The patient has always been well. She has had a small goiter for a number of years. Three months ago while teaching school she became unconscious and since that time she has had a rapid heart. Save for a small uniformly enlarged, soft right lobe, examination was negative. The right lobe was removed. At operation the major portion of the enlargement proved to be well separated from the remainder of the gland (Fig. 1). On section it showed an increase of colloid, which on microscopic examination showed distinct vacuolization with some degeneration and separation of the cells from the basement membrane (Fig. 2). The whole picture is that of degeneration, there being little or no evidence of reaction. The larger portion only required removal. The result was complete and permanent recovery.

CASE 2. Matron, age 23. This patient has had a small goiter for 7 years. She has been nervous since marriage, now two years ago. She had a small circumscribed enlargement in the lower pole of the right lobe, tremor, and rapid heart. She improved promptly with sedative treatment but there is a tendency to relapse at times. Here operation would give brilliant results and may confidently be recommended.

CASE 3. Schoolgirl, age 13. Her mother had dysmenorrhœa as a girl and was operated on a year ago for a myoma of the uterus. The patient has always had good health. A year ago it was noticed that her neck was enlarging. This has continued to the present time. She has a moderately enlarged thyroid gland which is slightly more pronounced on the right side. The pulse is 78. She received one grain doses of thyroid extract twice a day. The gland gradually reduced in size and in six months was scarcely noticeable. She had her first menses two months ago and though the flow was severe for a week she had little pain. During this time and following she was very nervous and it was noticed that the neck was again rapidly enlarging. The pulse was 100 to 120 and there was some tremor. She was given hydrastis and iron and the rapid heart and tremor have gradually subsided.

In this group there is no pronounced associated disease, though, as in these cases, there is usually some event that might be ascribed as an exciting cause, as in the cases above noted, but they are of slight importance and their action is not great enough or sufficiently prolonged to vitiate the good prognosis.

b. The second group, usually more mature than those of the first group, includes those in whom a goiter appears coincident with or is anticipated by some other disturbance. Perhaps they have been reduced by excessive study, or a menstrual disturbance may precede by some years the thyrotoxic symptoms. These patients usually recover with the relief of the underlying conditions. The overworked schoolgirl requires rest and tonics and the dysmenorrhœic requires appropriate treatment. This usually implies sedatives and proper living, rarely operation. The underlying condition usually has existed for a

Fig. 1. The encapsulated larger portion at the top of the figure represents the diseased part.

long time and frequently the condition cannot be improved for economic reasons. If there is a distinctly encapsulated adenoma, operation may be done with every assurance of success. Generally speaking patients of this group usually remain labile, however, and a repetition of the exciting cause may precipitate a new attack. Unfortunately the recurrences may be more pronounced than the previous one and an operation may be done in the hope of breaking up the sequence. These cases occur most frequently in individuals whose reproductive functions are still in an anticipatory attitude. The thyroid bears evidence of excessive or perverted secretion rather than a direct anatomic change. Possibly this is a response from stimuli received from afar and when these stimuli cease to act the hypersecretion subsides. I have too often seen this type subside after marriage to be able to regard this as a mere coincidence. Sad awakening sometimes brings a recrudescence of symptoms. The patient returns after a few years laden with the fruits of reproduction but with a lacerated and displaced uterus. It is now the surgeon's turn to establish a readjustment.

CASE 4. Housekeeper, age 25. Last June she began to have soreness and distress in the bowels while undergoing a considerable nervous strain. She had weak spells and was often short of breath. She has a dysmenorrhœa which was becoming progressively worse. She has recently lost weight. She has a small uniformly enlarged goiter, the pulse is 120 and there is a marked tremor. Under sedative treatment and rest she recovered. Two years later she complained again of dysmenorrhœa and a choking sensation at those times but not at others. The pulse was 90. She quickly recovered under

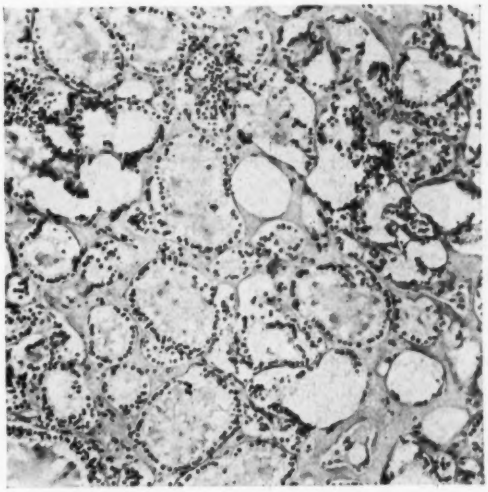

Fig. 2. The amount of colloid is increased and shows vacuolization. The cells are loosened in some parts.

sedative treatment and for a year was quite well. At this time she took a severe cold during menstruation. The symptoms became much aggravated and since then have responded but slowly to general treatment. At the present time she is easily exhausted, still retains some tremor and tachycardia.

The fundamental factor here is a menstrual disturbance. If this could be remedied the thyroid would be more stable.

CASE 5. Stenographer, age 30. She has not been well for a number of years. She was nervous and sleepless and had spells of tremor. She had pain in the groins, hips and back. The flow lasted 3 to 4 days but sometimes stopped short in the midst of it and after an interruption of a day returned. The pulse was 100 to 120, tremor, the apex was diffuse and bounding. She had a moderately enlarged goiter which involved markedly the isthmus but no circumscribed nodule could be made out. The uterus was retroverted and lay deeply in the pelvis and was very tender to bimanual examination. The thyroid symptoms were always greatly exaggerated during the menstrual period.

The uterine displacement was corrected by shortening the ligaments. She slept better and the pulse decreased to 84 and she gained some weight. After numerous remissions and exacerbations a partial thyroidectomy was done with some improvement, as after the operation on the ligaments. She still has her ups and downs, though on the whole is better than she has been for many years. She is not quite sure whether operation has been of any great benefit. She is nervous but does not exhibit it to her friends.

Fig. 3. The diseased portion is well encapsulated. The upper portion shows hæmorrhagic infiltration while the lower shows cysts.

c. The final group of adolescents includes those who are distinctly neurotic and whose home environment is usually bad. These patients exhibit pronounced neurotic tendencies; sometimes they are even pronouncedly hysterical or are subject to epileptic seizures before the goiter is observed. It is difficult to conclude at just what point the thyroid intoxication becomes manifest. Usually a record of the pulse rate and the tremor give the best indication. These patients do badly under any treatment. Even when the thyroid involvement is well localized and the relief of the thyroid element is quite certain, there still remains the primary neurotic condition, and the patient and her mother will most certainly regard the treatment as having failed if the neurotic condition persists. Usually these patients had best be consigned first to a neurologist. He may help them and at least he serves as a convenient buffer after operation, which, generally speaking, is useless.

II. *Adult type.* In this type are included those who have attained maturity before the appearance of thyroid enlargement, or, if an enlargement was present during adolescence, it has been in abeyance many years. This type deserves separate consideration because expectant treatment is less hopeful, as often there are associated diseases elsewhere and because of the social state of the patient operation is less objectionable. Most of them being married a scar is less objectionable than in single women.

a. *Cases previously well.* In this group we include the patient who has been healthy until the advent of the goiter. Many of these had a goiter during adolescence and the goiter has disappeared with or without treatment. Usually without discoverable cause nervousness and palpitation develop. Usually the degree of intoxication is not great, though sometimes hyperacute cases are observed. If the enlargement is confined to a sharply outlined portion of gland, operation should be done. Many of these patients have associated disturbances but there is not apparent any causal connection or any interdependence. Parous women naturally often show pelvic lesions of a minor sort. In this type the onset is usually gradual, and the degree attained is usually not severe. Often these patients come complaining of conditions wholly irrelevant. If they can be given the requisite rest they often improve satisfactorily. Usually

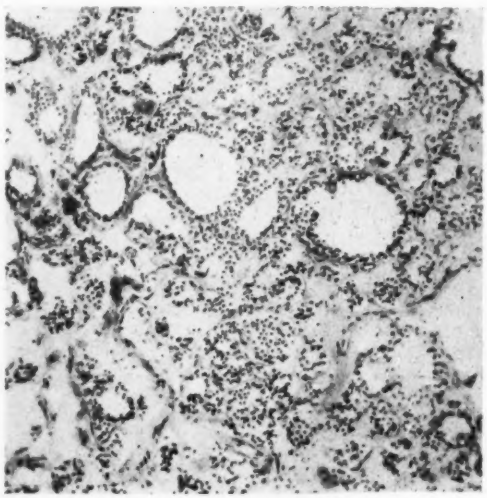

Fig. 4. The colloid increase is slight but there is marked round cell infiltration.

these are better treated by operation. An effort is made to remove the portion affected. This is usually done if the involved portion is strictly limited. In such cases the recovery is prompt and lasting. When one lobe only is enlarged, the removal of this may secure a lasting cure. That a recrudescence of the disease may occur with the enlargement of the other lobe must always be kept in mind. In this type when there is much glandular involvement with but little signs of intoxication, operation should be done.

CASE 6. Bank cashier, age 37. The patient complained of general weakness, shortness of breath and nervousness. Until a year ago she had always had good health. At this time the symptoms above complained of gradually developed. She now has occasional headaches and choking spells. Menstruation has always been regular and painless. She has lost some weight. The patient has marked enlargement of the right lobe of the thyroid. She has tremor and a pulse rate of 120. The apex beat is diffuse and the sounds loud but clear. The right lobe was removed. Gross section showed a well encapsulated thyroid lobe, portions of which have undergone degeneration (Fig. 3). The microscopic examination showed small celled infiltration in the connective tissue, some proliferation of cells but little increase in colloid (Fig. 4). The pulse after lobectomy dropped to 80 before she left the hospital. Recovery has been complete and permanent.

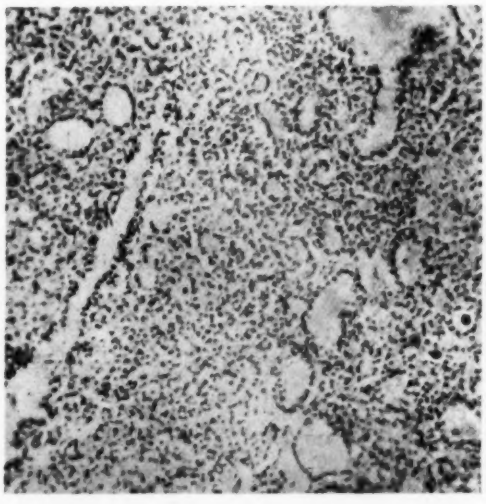

Fig. 6. The colloid, considering the character of the tissue, is relatively great, confusing in some places the usual picture of fœtal adenoma.

Fig. 5. The tumor is completely circumscribed, presenting the typical appearance of a typical fœtal adenoma.

CASE 7. Housekeeper, age 23. She has always had good health except for some minor diseases of childhood. For several years she has noticed an enlargement of the neck. A year ago she became nervous and had attacks of palpitation. She had a moderate size, uniformly enlarged thyroid, moderately soft in consistency. There was no pulsation of the gland and eye signs were absent. Pulse 132. The right lobe of the gland was removed. On section an encapsulated area was discovered which was not suspected during the operation. The upper lobe was composed of large vesicles filled with colloid. The encapsulated portion showed the usual glandular type which in some areas had become infiltrated with blood. The upper portion showed a pronounced increase in the colloid material. This material did not take the basic stains but on the other hand was slightly acidophilic. It showed vesiculization in many regions. The cells were flattened, in some regions there was evidence of protoplasmic degeneration and in some places the cells were loosened from the septal walls. The patient recovered quickly and has remained well.

CASE 8. Housewife, age 41. She has had six children and one abortion 12 years ago. For the past six years she has had tumultuous beating of the heart whenever she becomes agitated. She sometimes has smothering spells. Despite a good appetite she is losing weight and strength. The menses are regular, flows two days, stops, then flows again for a day. She has indefinite abdominal pain and dragging in the back. The patient has a fine tremor of the hands. The heart is not enlarged, the pulse 125–140. There is a nodule the size of a turkey's egg in the isthmus. The uterus is enlarged, retroflexed and tender, and there is a second degree perineal laceration with rectocele. The nodule is well circumscribed and is readily shelled out. The cut surface shows a uniform granular appearance (Fig. 5). The sections show a small celled infiltration in the acini and marked colloid increase (Fig. 6). The pulse came down to 75 on the fifth day after operation. Recovery was complete and permanent.

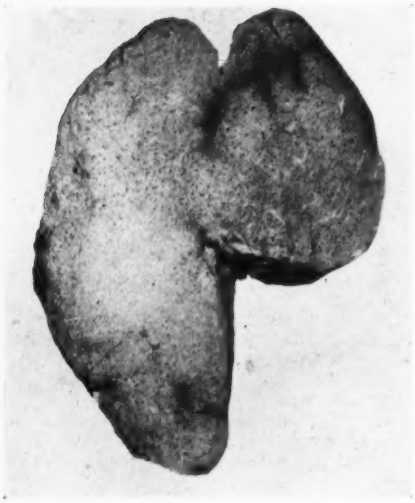

Fig. 7. The lobe and isthmus present a uniform fine granular appearance without distinct colloidal masses or cysts.

b. *Cases with associated organic disease.* In those cases in which the nervous state has existed and gradually increased before the advent of thyrotoxic symptoms we must search for factors which may have caused it. If such are found they should be removed before the thyroid symptoms are combated. These patients should first of all be relieved of those things which make them nervous. Perhaps relief from the strain of housekeeping may aid in establishing an equilibrium. In another class of cases the pelvic organs are most frequently the source of the increase in nervousness. Uterine sedatives may be useful and in some cases pelvic operations may be required. Married women with pelvic symptoms resulting from childbirth furnish a large contingent to this group. A correction of the associated lesion may bring about relief, or a thyroid operation may be advisable. Constitutional diseases or habits may furnish the foundation for pelvic disorders which secondarily find expression in hyperthyroidism. These cases are well worth studying, for there is no question but that there is close association between the pelvic organs and the thyroid. These patients nearly all improve under rest, but the improvement is not permanent. If the uterine trouble is pronounced and antedates the thyroid trouble, it should receive attention first, particularly if the goiter is small and uniformly enlarged. If circumscribed it is usually well to remove the goiter first.

Case 9. Matron, age 34. She had one child 5 years ago and has had pelvic trouble since. At a pregnancy two years later she had albuminuria, convulsions, and spontaneous premature labor. Immediately following this she developed goiter and extreme nervousness. The cervix was lacerated and eroded, the uterus was large and sensitive to pressure. The perineum also was lacerated. The pelvic repairs were made and the patient placed on general treatment. She improved markedly and for ten years felt well in general except that she suffered from a rapid heart when suddenly excited. However, she regarded herself as well. Just recently, ten years after the operation, she has missed her menses, evidently the advent of the menopause, and a recrudescence of all symptoms has appeared.

c. *The neurotic type.* This type develops an indefinite train of symptoms on a previously neurotic basis in which the underlying factor is for a long time not suspected. Suddenly a pathognomonic symptom may appear which clears up the problem. Usually it is a goiter which, added to an existant tachycardia, makes the diagnosis possible. Eye signs are usually absent. In cases where the observer suspects but cannot prove hyperthyroidism, aid may be derived because of their susceptibility to epinephrin and thyroid extract. The former gives evanescent increase of symptoms not always easy to recognize. The latter must be used with caution because its use may make the patient permanently worse.

These patients seldom have large goiters. Those who have had adolescent goiters may show considerable enlargement. They are nonpulsating and uniform in size, sometimes with the right lobe predominating. They may be small, doubt being entertained whether they are enlarged at all or not. In those cases in which a goiter has long existed it is well worth while to study carefully the patient's state before the advent of the suspected hyperthyroid symptoms. The presence of goiter may mislead one into diagnosticating hyperthyroidism when the condition may be true neurotic or a positive mental

aberration with an innocent goiter. Such patients may become increasingly nervous and yet not show definite hyperthyroid symptoms. Such patients should be placed in a hospital for a week or two for observation. A pulse curve may be of importance. The pulse is prone to be more rapid in the morning. The presence of tremor is the most important sign; the two taken together warranting a presumptive diagnosis. One sometimes sees these conditions in women who have been ovariotomized. In these the conditions are doubly complicated and wholly without relief by any means. One is often persistently urged to operate in the desperate hope of finding something which will relieve the afflicted patient and the long-suffering family. These cases differ from the adolescent neurotic with hyperthyroidism, for time usually has brought minor complications, and efforts at cure have added to the original burden.

CASE 10. Matron, age 35. The patient had one child 12 years ago and one abortion 5 years ago. Since the abortion she has had headache which extends from the nape of the neck down the spine. The headaches were so severe as to require morphine four years ago when she had nervous prostration for 4 months. She now has these headaches twice a week. She is nauseated but never vomits. At the beginning of the attack she has tenderness at the base of the brain and on the top of the head and tingling down the finger tips. The menses are regular but scant with moderate pain in the lower abdomen. The flow lasts a few days, stops, then starts again. The headaches are most severe at the close of the flow. She weighs 95 pounds which is much under weight. The bowels move five times a day unless controlled by an opiate. She had an operation 8 years ago for retroflexion, and the right kidney was anchored 5 years ago. She has choking spells when first lying down. She sleeps indifferently despite the fact that she takes ¾ grain of morphine per day. She says her mother always has been nervous and that she herself will always be so.

The patient greets the examiner with an I-defy-you-to-cure-me expression. She is sensitive wherever touched and one instinctively touches her lightly. She has a medium sized, uniformly enlarged thyroid, the date of the genesis of which she does not know. It is firm and movable. There is a fine fibrillar tremor but no eye signs. The pulse is 126; the apex heat bounding and diffuse. The right kidney is movable, the uterus is retroflexed, tender, and the cervix eroded.

The remittant menstruation and exacerbations of the headache at this time suggest an endometritis, and save from the pronounced character of the neurotic symptoms would demand correction of the uterine trouble. The symptoms of thyroid intoxication should demand operation, but true to her prediction she will always be a neurotic like her mother.

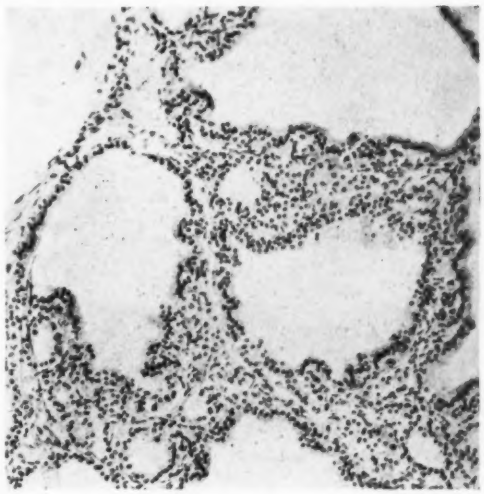

Fig. 8. The acini are all dilated and present papillary projections into their lumina. There is also extensive round cell infiltration.

III. *The typical exophthalmic goiter.* In the typical exophthalmic goiters, previous nervous states and associated disease of other organs seem to play a less important rôle than they do in the ordinary cases of thyroid intoxication. Very often there is evidence of general family degeneracy of some sort, either physical or mental rather than nervous, as characterizes the more simple group. Nevertheless, the thyroid trouble so overshadows the associated conditions that it must receive full consideration first, attention to associated lesions must be deferred until the thyrotoxicosis has subsided. Usually the patient has enjoyed a measure of health with perhaps some minor ailment up until the time of the advent of hyperthyroidism. Excessive nervous strain, such as child-bearing, trying work at school, and the like may have preceded, but without any attendant nervous state. More or less suddenly the patient discovers that she has palpitation and is short of breath, has tremors and may be troubled with insomnia. She discovers the neckbands

Fig. 9. The cut surface shows extensive secondary degeneration, hæmorrhagic below and hyaloid above.

of her dress are too small and in some instances friends may note the staring eyes. This may all take place within 1 to 6 months. Not infrequently the onset is very much more sudden, often following a shock or great grief, but most often without any known cause; within a few days the symptoms may be present.

The subsequent course is very variable. In the hyperacute, high fever and delirium appear early, vomiting and rapid emaciation follow quickly and death takes place in from 2 to 6 weeks. No treatment is of avail. I have seen six of these and I have not the remotest intention of operating on such cases.

Less stormy cases are the more common. The patient develops the symptoms less quickly. There is often fever, not infrequently extreme nervousness, even delirium; emaciation is rapid, often extreme. They have acetonuria and sometimes a dry typhoid tongue. These last differ from the group just mentioned in that after a time the delirium disappears, the fever subsides and they begin to gain in weight. I tried operation on one case in the vain hope of halting her in the downward course. Never again! If treated expectantly this group usually reaches a climax, then the symptoms subside and finally the patients return to normal weight. They can then be operated on with a certainty that the road to recovery will be much expedited and relapse prevented. The time and character of the operation must be selected with care.

In some of these cases there seems to be an associated or non-suppurating thyroiditis. They present the usual phenomena of excessive local tenderness to touch, the feeling of heat on palpation and in extreme cases there may be slight hyperæmia of the skin. The presence of a true reaction is best appreciated when these cases are operated on. The adhesion between the gland and its capsule is such that separation can be accomplished only after the most painstaking labor, and sometimes the operator is willing to compromise and remove less of the gland than he had originally planned.

The usual run of cases is less acute than the group just mentioned. They lose flesh but never have delirium and but little if any fever. As soon as the lost weight is regained, or if no loss of weight occurs, the patient may be operated on with a certain prospect of expediting recovery. In the milder cases operation may be done early and the development of the disease checked. Though the mortality is small there is always the risk of a stormy scene during the first day or two.

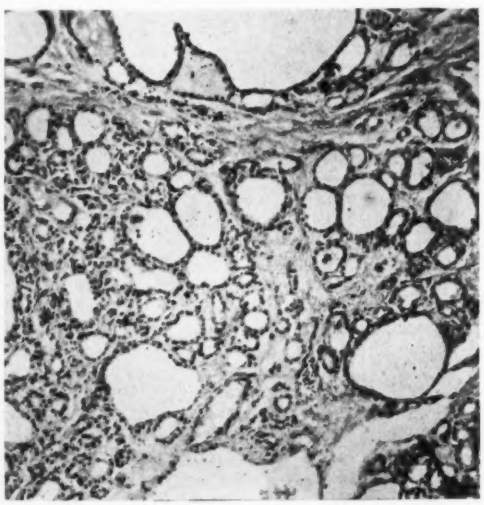

Fig. 10. Colloidal increase is noted here at the expense of the gland elements.

If one fears this a vessel or two may be ligated, thereby anchoring the patient to him, thus assuring obedience to his suggestions for subsequent treatment. That pole ligation is an innocent procedure is denied by those who have had much experience with it. The mortality even in competent hands rivals that of lobectomy. I doubt very much if this can be true when the operation is done under local anæsthesia. If the patient is free from acetone and has no fever, this operation may be done notwithstanding the patient is much emaciated. As to any direct benefit from the ligation *per se* one may well entertain a doubt, except in those cases in which there is a strongly pulsating gland. In these the superior thyroid arteries are felt as distinct pulsating cords. Not infrequently these can be directly seen. Ligation in such cases is commonly followed by prompt gain in weight and other evidences of improvement. The superior thyroid nerve as well as the artery must be destroyed.

If one lobe only is enlarged, early radical treatment is less dangerous than if both lobes are equally enlarged and success is much more certain. If both lobes are equally enlarged, improvement is likely to be only partial or temporary, and the patient must

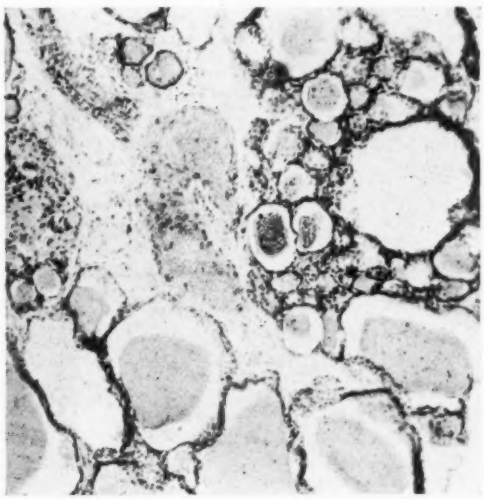

Fig. 12. There is a marked increase in colloid with little cell infiltration.

Fig. 11. The cyst is shown collapsed. The remainder of the gland shows small dots of colloid visible to the naked eye.

be told that further operation may be necessary. Even when one lobe only is enlarged or predominantly enlarged and the improvement is prompt and satisfactory, the patient must be told that the other lobe may enlarge at some future date and require operation. If this does occur, it too must be operated on. In such an event it is expedient to reoperate early unless a brief trial at sedative treatment proves promptly efficacious. When both lobes are enlarged a partial removal of both lobes may be done at one sitting, but this increases the risk. For this reason I prefer to operate on one lobe at a time. The degree of risk is determined by the degree of toxicity.

In some cases with exophthalmos the enlarged part is circumscribed, even encapsulated. When completely encapsulated the mass is usually situated in the isthmus, less often in the lower pole of the right lobe. These represent fœtal adenomata that have suddenly taken on activity of growth and obviously of secretion. In such cases the results of operation are brilliant. All symptoms save the exophthalmos vanish at once after the offending mass is removed. In the majority of cases of encapsulated goiters with intoxication, however, there is no exophthalmos.

The true exophthalmic cases are characterized by a true proliferation of the gland substance. Instead of there being an increase of the acini or of the multiplication of the glands in fœtal adenoma, there is a genuine papillary proliferation, resembling that seen in serous ovarian cysts. The proliferation may be so pronounced as to mislead the unwary into

diagnosticating malignancy. No case has yet been reported in which true malignancy was associated with exophthalmic goiter.

Finally it must be noted that the most carefully conducted operative procedures may fail to secure the desired results. Expectant treatment may rival in results those achieved by surgery, but the latter under favorable conditions may secure in months what the former can attain in years. Besides, surgical treatment does much to prevent relapse, cardiac degeneration, and the rare but disastrous hyperacute termination.

CASE 11. Matron, age 28. The patient has one child 6 years old and has had three abortions. She had a hard labor and soon after she noticed that her neck was enlarging. She became nervous and had palpitation. She received a fright when the barn burned. Soon after it was noted that her eyes had become staring. She has lost 30 pounds.

She has a marked exophthalmos, pronounced Kocher, Graefe and Dalrymple signs. The pulse is 120 to 160, full and quick, the apex is diffuse and it extends lateralward and downward. She has a medium sized goiter which is soft and markedly pulsating. The uterus is large, retroverted, lacerated, and tender, and there is a second degree perineal tear. Pole ligation was done and she has regained her weight, and the nervous symptoms have improved considerably. Four months later a lobectomy of the predominating right side was done. She declares herself well, but the heart is still unstable and she is easily excited and the exophthalmos has subsided but little. The pelvic lesions should now be corrected but she finds herself so much improved that she does not mind the headache and backache.

CASE 12. Laborer, age 30. The patient has been sick three and a half months. He complains of shortness of breath and a weakness of the knees. The trouble with his legs has been so marked that he had to quit work for he never knew what moment he might be precipitated to the ground. The lungs and legs were negative on examination. The pulse was 120, full and bounding. The apex beat was diffuse. There was marked tremor. There was a moderate exophthalmos but no other eye symptoms. The right lobe and isthmus were removed (Fig. 7). He improved promptly and in 2 months was able to do normal labor. Eighteen months after the first operation he reappeared with a repetition of his complaints. He had lost 20 pounds in 6 weeks. He has an enlarged left lobe, exophthalmos and a well developed Graefe. Two-thirds of the left lobe was removed. Improvement has been as prompt as after the first operation.

The gland showed a uniform structure which on section presented a papillary proliferation of the epithelium (Fig 8). This gland shows the typical microscopic picture of the exophthalmic type. The eye signs obviously are dependent on a certain type of gland change.

IV. *Secondary hyperthyroidism.* In this group may be included those patients who have long had an "innocent" goiter, annoying only because of its disfiguring effect. These patients are normal in every way, at least are not conscious of nerves. They are seen most frequently in women at or past middle life. Gradually they develop dyspnœa, at first, perhaps ascribed to pressure from the enlarged gland; then come rapid heart and tremor. They rarely have eye signs. This type is apt to have dilated hearts. It is not easy to distinguish the rapid heart of degeneration from that of intoxication. Generally speaking, the toxic heart is most rapid in the morning even when the patient is kept in bed, while in myocardial degeneration rapidity increases with exertion. Often in the latter, direct evidence of myocardial degeneration may be discovered. Myocardial degeneration may antedate the other symptoms of toxic goiter. The "innocent" goiter apparently gradually destroys the heart muscle before the symptoms of intoxication appear. At any rate, serious myocardial degeneration appears earlier than after the other forms of the disease. The importance of an exact differentiation is found in the fact that a myocardial degeneration does not disappear after the subsidence of toxic symptoms. Furthermore, patients who have myocardial disease and subsequently develop toxic symptoms usually die soon from progressive myocardial weakening, no matter what the treatment.

On the other hand, the patient with the cardiac symptom, even with considerable dilatation, but without much change in the heart muscle itself when the offending thyroid is dealt with, recovers promptly. Generally speaking, symptoms of hyperthyroidism are relieved by operation in proportion to the degree of localization of the process. In adenoma the symptoms disappear at once, including the cardiac hurry. Fortunately often these patients have had one lobe predominantly enlarged so that it is possible to get rid of most of the affected portion by operation. This type should be operated on early. Not

infrequently these patients have marked pelvic disturbances, but the cure of the pelvic lesion has no effect on the goiter. My practice in these cases is to do the pelvic operation first under ether and the goiter a week later under local anæsthesia. I am perfectly willing to give these patients ether for the pelvic operation but not for the goiter operation. In this way the patient can have both conditions relieved by the stay of two or three weeks in the hospital.

In structure these goiters are colloidal and differ from classical colloids only by the change in staining reaction, vacuolization, and sometimes round-celled infiltration. It is important to note that usually but a small part of the gland is involved and unless the examiner is persistent the affected portion may be overlooked. These never show much gland proliferation and never papillary formation. This fact accounts for the absence of eye symptoms.

Goiters which exist for a long time are not innocent unless they have become calcified. Unless they do become calcified, while they may not become toxic or undergo malignancy, they may have a deleterious effect on the heart muscle. How much we may do toward preventing these changes by operation is dependent on how much of the offending portion of the gland we may be able to remove.

CASE 13. Matron, age 55. The patient has had three children, no miscarriages and had passed the menopause two years ago. For several years prior to passing the menopause the menstrual flow was irregular and excessive. She has had a goiter for 30 years. It grew slowly until 4 years ago, but since that time it has not grown. Since the menopause she has had nervous spells and palpitation. The goiter seemed sensitive at times and seemed to disturb her respiration. Her sleep has been somewhat disturbed. There was a moderate, fine tremor. The thyroid isthmus showed a mass as large as a goose egg (Fig. 9), and a smaller nodule in the upper pole of the right lobe. The pulse was 86. The nodule was removed. The disturbance to respiration seemed the only certain indication. The removal of the nodule resulted in the prompt and complete subsidence of all complaints.

It seems fair to assume, therefore, that the part removed was exerting a mild intoxication. This gland bears out the assumption that when a gland long existent produces symptoms it is due to an increased colloidal secretion and not to proliferation (Fig. 10). It is due to this fact likely that improvement is so prompt and lasting after operation.

CASE 14. Matron, age 36. She has had enlarged thyroid for many years. She was never conscious of any disturbance from it. A year ago she became nervous and trembly. Examination shows the pulse 100. She has a marked tremor, and has lost a little in weight but feels weak out of proportion to the amount of weight lost. A right lobectomy was done. She left the hospital on the fifth day with a pulse of 80. She was completely relieved of all symptoms. The specimen showed a cyst as large as a small apple in the upper lobe. The section showed cellular activity and marked increase of colloid.

This type shows less prompt and lasting recovery than the preceding one.

CASE 15. Widow, age 53. She had one child 25 years ago and passed the menopause 5 years ago. She first noticed her goiter 18 years ago. A year ago she had pain in it for the first time. Since this she has had difficulty in going to sleep. She is exceedingly nervous and worries a great deal though according to her own statement she has nothing to worry about. She has night sweats and has lost considerable weight. The pulse is 96 and there is marked tremor of the hands. There is a well circumscribed tumor the size of a small apple in the isthmus. The tumor was removed. The pulse dropped to 66 before she left the hospital and her other symptoms were relieved. The tumor contains several cavities filled with straw-colored fluid. The remainder is whitish pink and granular. On section this is seen to be adenoid tissue.

V. *Atypical.* In this group those cases may be placed which, because of their course or form, depart widely from the usual. One may observe them many months, even years, before a definite diagnosis is possible. They may present the general symptoms of a neurotic. The one dependable clew is that they lose weight, regain it, and lose it again. A typical neurotic does not do this. The toxic cases likewise when placed in bed often show a high morning pulse with a lower one in the evening though at no time is the pulse high enough to designate it as tachycardia. For instance, a patient may show a pulse of 80 at a number of examinations, but if placed in bed the nurse may find the pulse 90 to 95 in the morning hours before it is time for the doctor to make his rounds. If in addition to

this there is tremor the diagnosis is strongly presumptive. Often in such cases a thyroid enlargement or eye signs may reward the astute observer for his pains. Operation does these no good but they recover unless a too doting family thoroughly convert them to the joys of invalidism. This type is often operated and reoperated on without noteworthy results. Everything about them is defective and one cannot make a plus by taking still more away from a minus. In these more than any other type one must study the state of the patient before she became sick.

In another group, small fortunately, an exact diagnosis may never be possible. The small hard thyroid, possibly existent for many years, may be palpated perhaps if its is sought for. The patient may be a confirmed neurotic presenting a complete picture of a neurosis. Often if one searches the past history he may receive a clew. True neurotics are congenitally introspective and selfish. If in the absence of such a history the general symptoms of an indefinite neurosis develops, the possibility of an endocrin disarrangement must be kept in mind.

CASE 16. Baker, age 52. The patient has always had good health until 5 weeks ago. Without known cause he began to feel worn out and had palpitation of the heart. The palpitation was made worse by excitement rather than by exertion. His sleep has been much disturbed by the nervousness. When he entered the hospital he had a pulse of 106, temperature 100, respiration 30. The lungs and abdomen were negative. The apex was outside of the nipple line and was diffuse. The right border was near the midline of the sternum. The mitral sounds were somewhat muffled, but there were no murmurs. The leucocyte count was 9000. Because of the persistent low fever and the heart findings a probable diagnosis of endocarditis was made. The significance of an apprehensive nervousness was entirely overlooked. Rest in bed for several months was attended by general improvement. He returned in two months in much the same condition as on his first entrance. He had at this time Kocher and Stellwag signs rendering the diagnosis easy. A month later the right lobe of the thyroid was found to be enlarged. This enlargement remained apparent for six weeks, then gradually disappeared. The disappearance instead of being attended by improvement was followed by an increase in the nervousness amounting to actual mental disturbance at times. He subsequently improved and returned home. Here he had a rather sudden exacerbation and died.

In approaching the study of the therapeutics of goiter it is helpful to have observed cases untreated in order to obtain a knowledge of the life history of the disease. If one has not had this opportunity it may be obtained in a measure by reading the earlier literature. The young man is too apt to assume that whatever good follows his efforts must have come because of such efforts and if disaster is averted it must be because of his efforts.

It should be ever kept in mind that the general tendency is toward recovery and that many do recover spontaneously. Recovery may be expedited by judicious operations. The time for operation must be carefully selected and the operation chosen must be commensurate with the resistance of the patient. Above all the operator must ever hold the fact before himself that his operations must be without mortality lest his therapeutic endeavors prove a greater menace than the disease.

THE SURGICAL TREATMENT OF EXOPHTHALMIC AND THYROTOXIC GOITER WITH SPECIAL REFERENCE TO BILATERAL RESECTION[1]

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THERE is no subject, in the category of medicine, about which there is so much diversity of opinion between internist and surgeon, as there is in the treatment of exophthalmic goiter. There is, moreover, no uniformity in procedure as to operative indications and operative technique among surgeons themselves. The whole subject seems to be in a chaotic state, and this, no doubt, is due to the fact that the actual etiology of the disease is still unknown.

McCarrison (1) says: "There is no definite proof that the cures effected by surgical means (that is by hemi-thyroidectomy alone or with ligation of arteries) are more lasting than those effected by medical means." He has done excellent work on diseases of the thyroid and has pointed out the importance of searching for focal infections, but, without minimizing the importance of these infective foci as etiological factors of obscure diseases, how often one finds that even after all are removed, these cases are not cured, and conversely, it is seldom that one finds associated with extreme oval sepsis, infected gall-bladders and appendices, or profound intestinal stasis, exophthalmic goiter.

Medical treatment in Graves' disease has not been eminently successful. Thus Sattler (2) estimates the mortality at 11 per cent. In Hector McKenzie's (3) experience, the mortality has been about 25 per cent, and others report as high as 30 per cent. The large percentage of uncured cases from medical treatment is also discouraging. Kuttner (4) traced 9 patients who had been under medical treatment for 15 years, but not one had recovered health. In Osler's *System of Medicine* the statement is made that it is a disease, from which few recover and some die.

While medical treatment has made little advancement, surgical treatment has progressed steadily. Osler (5) says that removal of the thyroid gland offers the best hope of permanent cure and quotes the statistics of Kocher and the Mayos giving the operative mortality below 4 per cent, and cures of some 70 per cent. Forchheimer (6), while stating that the physician who recommends operation in Graves' disease should at least have exhausted all other means of treatment, says that operative procedure on the thyroid gland as a logical and scientific mode of treatment is fully admitted.

It must be admitted that there is a certain percentage of cases that are cured and remain cured by medical treatment alone. Thus we have Hale White's (7) analysis of 200 hospital and private cases investigated over a period of 20 years, 102 of which were traced, and of these he gave the cures at about 50 per cent. This leaves a margin of uncured who finally look to surgery for relief.

Among surgeons there is no unanimity in opinion regarding the surgical procedure. Thus, Rogers (8) claims 70 per cent cures from ligation of the four thyroid arteries. Walton (9) says that hemi-thyroidectomy is the operation of choice. Others, as Kocher, the Mayos, and Ochsner do a lobectomy with or without partial resection of the remaining lobe. Donald C. Balfour (10), in pointing out the advantages of bilateral resection in simple goiter, says its field of usefulness is very limited in the exophthalmic type, while Halsted (11) advocates bilateral resection as the method of choice with or without preliminary ligation of one or more arteries as the case might indicate.

Since 1912 I have done bilateral resection on 31 cases of true Graves' disease, or cases with positive symptoms of hyperthyroidism where both lobes of the thyroid were enlarged. All cases operated upon that did not have definite tremor and tachycardia have been excluded. There was no operative mortality in this series. My operative mortality for goiters of all types was one. This was one of my earlier cases of Graves' disease in which a single lobe was resected. It was done before the patient had sufficiently recovered from

[1] Read before the Western Surgical Association, Chicago, December, 20, 1918.

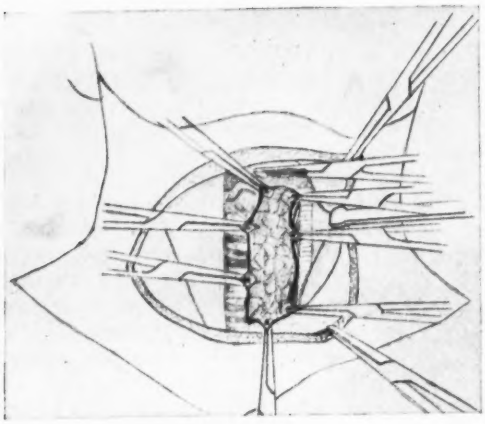

Fig. 1. Showing clamps applied to the vessels in the capsule and the part of gland in front of them cut away. The recurrent laryngeal nerve is shown in the drawing but does not come into view in this operation.

an exacerbation of symptoms. One other case died following an injection of boiling water into the gland. This was an extremely severe type of the disease.

The patient was a young girl and had been ill over five months. She had an enormous appetite, marked tremor, pulse rate 150 to 160 per minute, and flushed skin. After three months' absolute rest in bed and expert medical care under two of the best internists, improvement was very slight. Ten cubic centimeters of boiling water were injected into each lobe of the gland. In the afternoon patient was vomiting, pulse rate increased, and on the third day the heart began to fibrilate and she passed away on the fourth day.

Preparatory treatment such as absolute rest and medical care preceded every operation and in some injections of boiling water into the gland, as advised by Miles Porter (12), followed by ligation of vessels. In a few cases, after prolonged rest when the toxæmia seemed to be well controlled, bilateral resection was done without preliminary ligation. In some of my earlier cases a unilateral resection was done, and the remaining lobe dealt with later when relief was found to be incomplete. Two of my cases operated on in this way some years ago and who were not completely relieved, have not returned for second operation — although advised to do so — and I still think that in certain mild cases, especially where the enlargement of the thyroid is asymmetrical, the first operation should be limited to one side. This rule, I think, can be laid down as absolute in those thyrotoxic goiters associated with adenoma or cyst of one lobe. In most of my later cases with well-marked symptoms, who have gone through one or more severe exacerbations of toxæmia, bilateral resection was done at one operation. This has been more satisfactory, the cure more positive, and the patient saved the annoyance and inconvenience of undergoing a second operation.

Halsted (11) says that in several instances in which the ligation of three arteries, plus the excision of one lobe, has been attended with almost negative results, relief from all symptoms followed immediately upon removal of most of the remaining lobe.

It is frequently asserted that, as a result of operation, a condition of myxœdema may follow as an early or late sequela. But as Dunhill (13) says, the operation is being performed extensively and many critical eyes are watching results, and any cases occurring could scarcely escape observation. Personally, I have never seen such a result. To my knowledge no report of a case has as yet been recorded in the literature, nor do I know of a case being presented at a medical meeting. Conversely, cases are reported, and I have operated on such, where sufficient gland had not been removed. McCarrison (14) records one case having recrudescence of symptoms after operation, but does not state the type of operation done. It is obvious from the picture shown that an enlarged lobe still remains.

In estimating the amount of gland to be left for functional purposes I have been guided by the research work of the University of Minnesota, where it has been found that one-sixth of the gland is necessary in the adult, and one-third in the growing animal. This, however, applies to normal glands, while clinically, patients with exophthalmic goiter seem to do well when very little of the thyroid remains. In severe cases I have aimed at leaving the minimum amount of one-sixth of the gland, but in some of the less severe types somewhat more than one-sixth has been left. Many of the cases here recorded have been

Fig. 2. Both lobes resected and the portion of the gland left dropped back beside the trachea leaving the neck symmetrical.

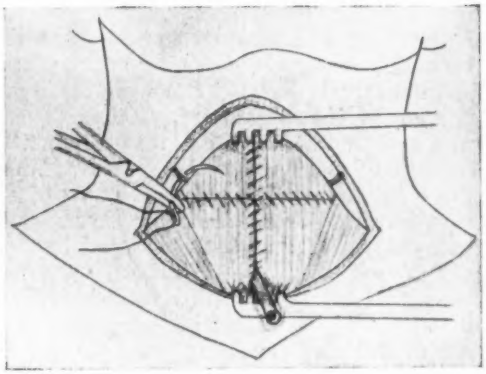

Fig. 3. Infrahyoid muscles sutured and tube inserted at the lower angle. When the tube is brought out through a separate stab incision a very noticeable scar remains. It is best brought out through the incision made and the resulting scar is easily covered by a small necklace.

observed over a number of years but not the slightest sign of myxœdema or hypothyroidism has been noted in any of them.

In cases of Graves' disease without obvious enlargement of the thyroid, the change from the normal is more microscopic than macroscopic; in other words, although the gland is not visibly enlarged, it has the same histological characteristics as in the cases where there is obvious enlargement. It has the same solid fleshy appearance in gross section, and microscopically shows hyperplasia of the cellular elements. The treatment in these cases should, therefore, differ in no way from those where definite enlargement is present, and one cannot see why Dunhill (13) advises against operating on them. He suggests that the cells are so closely packed that they will die from mutual pressure and that the gland will later atrophy.

One of my cases was diagnosed exophthalmic goiter though the eyes were not unduly prominent and absolutely no enlargement of the thyroid could be made out. There was tachycardia and tremor for several months. Six months later the thyroid was distinctly larger than normal. She had a successful resection of both lobes in two stages. I saw this patient 2 years later and her general health was good, although she was a sufferer from chronic pelvic trouble.

Though many of the cases presented themselves in a condition of pronounced toxæmia, few were so severe that with rest they were not sufficiently improved later to undergo operation. Two cases were practically moribund when first seen by me. One had declined operation of any sort some time before and died from the disease a few days later; another died the day after admittance to hospital. It cannot be emphasized too strongly that the time to operate may not be when the case first presents itself. In one instance the patient reacted so severely to injections of boiling water that operation was not considered until several months later when a preliminary ligation of the inferior thyroid under local anæsthesia was done, and both lobes resected two weeks later. In neither of these operations was there any reaction compared with that following the injection of boiling water.

One case was certified insane and on his way to an asylum when his real condition was recognized by Dr. J. E. Coulter, who asked me to see him. We did a preliminary ligation of both superior thyroid arteries, and two weeks later bilateral resection. Recovery both mental and physical was rapid and complete.

He returned to his farm and has been able to do his normal amount of work for over two years.

Another case had a ligation of the right inferior thyroid under local anæsthesia. There was such marked reaction that no further operation was advised until she had at least three months, longer rest. She improved so markedly in that time, and seemed so perfectly well, that no further operation was advised for the present. This case does not, therefore, belong to the series here recorded, but no doubt would have, had her symptoms persisted, and may yet should they return. As the thyroid is not a functionless organ like the appendix, we cannot conscientiously advise its removal after its first offence.

One of the advantages of ligating the inferior thyroid over the superior is that the incision is in the same line as that for resection. Its chief disadvantage is that the operation is more difficult.

TREATMENT

All treatment to be rational should be based on pathology. The surgical treatment of exophthalmic goiter is based on the theory of thyroidal auto-intoxication. Murray (15) says: "We do not as yet know the actual exciting cause of the special proliferative changes which are found in the thyroid gland in exophthalmic goiter." Whether further research should prove exophthalmic goiter to be a hypersecretion or an altered secretion of the thyroid, or only one phase of a complex disturbance of the functions of other ductless glands, one fact remains that the thyroid is never found normal microscopically in cases showing the symptoms of exophthalmic goiter (Kocher, 16; Berry, 17) and that removal of the gland gives positive, beneficial results, which results are often in direct ratio to the amount of gland removed. "Even the extreme advocates of the new theories ascribe the chief rôle in this disease to increased activity of the thyroid." If we accept the foregoing, why then are so many physicians opposed to surgical treatment? The reasons seem to be the former high mortality following operation, failure of complete cure from inadequate operation, and the fact that a number are apparently cured by medical treatment alone.

Indications for operation. Have we exact indications as to when or at what stage operation should be undertaken?

Recognizing that there is an ebb and flow in the symptoms of exophthalmic goiter, it is most important to time the operation to the stage of remission and not during the acute exacerbation. No doubt in the past the high mortality from operation in Graves' disease was due to the fact that cases came to the surgeon at the height of the paroxysm. Sufficient stress has not been laid on the time at which operation should be undertaken. Plummer (18) says that the time to operate is early in the attack or late when symptoms have passed the crisis. I have had no personal experience with operating early in the attack and it seems to me that more statistics should be available before one could say that operation was as safe then as it is when the attack has subsided. In all my cases I have employed rest and medical treatment until the acute stage had passed. No matter how severe the case, the first line of treatment should be absolute mental and physical rest combined with medical care, and the severer the symptoms the stronger should be the adherence to this rule. I would like to emphasize the fact that I consider exophthalmic goiter should never be considered a surgical emergency.

As already mentioned, medical statistics show that probably 50 per cent of cases recover entirely without the aid of surgery. Therefore, it would seem that in the first stage surgical treatment should not be considered, but medical treatment employed and operation only undertaken should the symptoms again recur or persist for a prolonged period. Again, were the first attack an unusually severe one, it would be justifiable to consider operation after it had subsided.

Undoubtedly there are cases that do not show this typical rise and fall of symptoms but run a more or less continuous course, and these should be operated upon. One must bear in mind that continued thyroid intoxication tends toward organic changes in the heart and other organs, and if this be allowed to progress indefinitely the damage done will be permanent. Surgery will arrest further dam-

age to these organs by reducing the output of toxins but cannot repair damage that has already been done. Landstroem (19) has drawn attention to this fact.

Contra-indications to immediate operation. Operations should certainly not be undertaken in those acute fulminating cases which Osler describes and in which Schlesinger (20) has pointed out the high mortality following operations.

Operation should certainly not be undertaken during the recent onset of acute intoxication in any stage of the disease.

In cases of organic disease of the heart the patient should first be under the care of an internist, expert in the diagnosis and treatment of cardiac conditions.

OPERATION

A factor of great importance in the operation is the anæsthetic. Almost every anæsthetic—general and local—has been used, but the one which seems rationally indicated is a combination of nitrous oxide and oxygen together with anocaine and adrenalin as local infiltration. It is to Crile that we are indebted for this development in anæsthetics, which aims at reducing to a minimum the element of shock.

A transverse incision, 2.5 or 3 inches long and a finger's breadth above the sternum, is made through the skin and platysma. The anterior jugular veins are divided between artery forceps and a flap of skin and platysma is dissected upward. The infrahyoid muscles are next separated along the mid-line and retracted laterally. If retraction alone does not admit of a sufficient exposure of the gland, the sternohyoid and sternothyroid muscles are divided transversely.

One lateral lobe is now freed by blunt dissection, or with the finger, and lifted into view. The superior thyroid vessels are caught where they enter the gland at the upper pole and are divided between forceps. The lateral lobe can now be pulled forward and several clamps applied to the large vessels as they are seen crossing the capsule of the gland in an anteroposterior direction. These clamps are applied just posterior to the line where the section of the lobe is to be made, and necessarily one has in mind when applying them the amount of gland to be left for the purposes of thyroid function. When all vessels in the capsule have been clamped in this manner, that part of the lobe in front of the clamps is now removed with the knife leaving the posterior part of the capsule and a small portion of gland in front of it (Fig. 1).

The isthmus may now be divided or left continuous with the detached portion of the lobe and the opposite lobe dealt with in a similar manner to the first. One or two small branches of the inferior thyroid artery in the substance of the gland may require ligation, but it is remarkable how little bleeding there is from the actual gland substance when all the vessels in the capsules have been carefully caught before section is made. Should oozing continue after all clamped points have been tied, the divided edges of the capsules may be sewn from side to side over the raw surface. It will be seen that no attempt has been made to secure the inferior thyroid artery before it has entered the gland substance. This is not only an unnecessary procedure but one to be avoided so that the circulation to the remaining portion of gland and parathyroids shall be preserved. Furthermore, this eliminates all possibility of injury to the recurrent laryngeal nerve, which does not come into view in any stage of this operation. The two remaining portions of the gland are allowed to fall back into the recesses on each side of trachea (Fig. 2).

The divided ends of the infrahyoid muscles are approximated with catgut sutures and a drainage tube inserted between these muscles down to the gland. The anterior jugular veins are surrounded with catgut stitches and tied on the deep surface of the flap some distance from the edges (Fig. 3).

The flaps are next secured by two sutures of silkworm gut. The first is passed through the skin and runs as a continuous stitch uniting the edges of the divided platysma, then out through the skin again; the second is a Halsted intradermic stitch uniting the divided edges of the skin. Thus no catgut remains near the suture line and the sutures of silkworm gut which close the incision are later completely removed. By this method an almost invisible scar is obtained.

ADVANTAGES

The advantages of bilateral resection over unilateral lobectomy or unilateral lobectomy with partial resection of the opposite lobe are:

1. Minimum injury to the parathyroids.

2. Absolute safety for the recurrent laryngeal nerve.

3. If for any reason further removal of gland should be indicated, such as for recrudescence of symptoms of thyrotoxic activity, or the rare but possible occurrence of malignancy, the one side could now be completely removed with an assurance that some portion of gland remained.

4. It is a physiological fact that where there are paired organs, should one be removed the other undergoes hypertrophy. This, while desirable in a condition where one is normal, is what we wish to avoid in the case under discussion, and this end is best obtained by double resection.

5. Finally, for cosmetic purposes, in the operation of lobectomy there is a well-marked depression on the side from which the lobe has been removed, and on the other side the portion of gland left produces an undue prominence, while in bilateral resection the neck is obviously symmetrical.

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LARGE VESICAL CALCULI

Report of a Case[1]

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OBSERVATIONS and descriptions of vesical calculi are found in the earliest medical literature. Perineal lithotomy introduced by Frère Jacques in the middle ages remained the greatest surgical operation up to the development of modern surgery.

New methods of diagnosis and operative treatment have been greatly developed in the last 15 years, so that the smallest stones which escaped detection, and the larger stones which had such a high rate of mortality following operation, can now be more surely and safely diagnosed and treated.

The exceptional case, which forms the subject of this communication, was treated in the Urological Service, Royal Victoria Hospital, during the last year. The following is a summary of the clinical record.

Patient, A. S., farmer, age 55, was admitted on February 21, 1918. (Case No. 588.90226.) He complained of frequent and painful urination. The history obtained was that about 20 years ago he had a severe attack of abdominal pain accompanied by hæmaturia. This attack lasted several days and never recurred. Since that time he has voided blood about once a year, but only after being "shaken up." Five years ago there was retention of urine for a short time. Since then he has had difficulty in starting urinary stream and urination has been accompanied and followed by scalding pain. There was constant tenderness in the bladder region which was worse while he was up and about. During the last month these symptoms have become aggravated. The frequency, which before had occurred every one and a half hours during the night, became half hourly. The suprapubic tenderness was more marked and the pains after urination lasted 5 to 10 minutes. No hæmaturia has been present since the fall of 1917; no urethral discharge; no calculi passed. The urine of late has been cloudy and ammoniacal.

Personal history. The patient had measles in childhood, whooping cough at the age of fourteen, the "grippe" for three consecutive winters, 1912–1914. He has had hæmorrhoids for 20 years. He uses alcohol at times to excess. He smokes heavily. He denies having had gonorrhœa or syphilis.

His family history is negative for tuberculosis, cancer, or lues.

Physical examination shows a fairly well-nourished, well-developed man, 6 feet in height. He is somewhat dull and rather phlegmatic. He lies in the dorsal decubitus in no apparent pain or distress. He can assume other positions with ease. The skin and mucous membranes are of a good color. His temperature is 97°, his pulse 96, and respiration 24.

The lymphatic system shows no generalized enlargement. The thyroid is normal.

The respiratory system shows no pathology save a moderate degree of emphysema.

Examination of the cardiovascular system shows the pulse rate 90, regular and of good volume; the blood pressure cystolic 148, diastolic 112; the vessel walls are moderately sclerosed. The heart shows a normal area of cardiac dullness; sounds at apex and base are clear and distinct; no murmurs.

The teeth are poorly preserved, with moderate pyorrhœa of the upper and lower gums. The tongue is moist and slightly coated in the center. The abdomen is flat and symmetrical, and moves freely with respiration. There is tenderness in the suprapubic region. No masses or organs can be palpated. There is no free fluid.

The skin and extremities show no abnormalities.

Examination of the nervous system shows that the pupils are equal and active to light and accommodation. Superficial and deep reflexes are present. Sensation is normal. There are no pathological reflexes.

Examination of the genito-urinary system discloses no tenderness in the costovertebral angle on the right or left side; no tenderness along the course of the ureters. The kidneys were not palpated. On the slightest pressure over the suprapubic region there is tenderness. An indefinite mass is palpated filling the bony pelvis. The penis shows redundant foreskin, no scars. The scrotum and contents are normal.

Rectal examination reveals in the prostatic region a large mass of bony hardness which is absolutely immovable. Bimanual examination discloses a mass between the rectal and suprapubic hand. The urethra would not admit a No. 12 French rubber catheter, meeting obstruction at the apex of the prostate.

The urine is cloudy, straw-colored, alkaline, specific gravity 1,018, and negative as to albumin and sugar.

Microscopic examination shows pus +++, epithelial cells, few red blood-cells.

[1]From the Department of Urology, Royal Victoria Hospital.

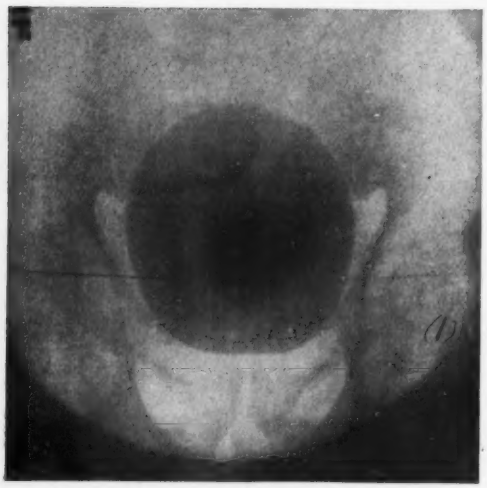

Fig. 1. Roentgenogram showing shadow of calculus.

The next day, February 22, 1918, the patient was skiagraphed and the X-ray plate (No. 26,498) showed a large shadow filling the true pelvis and extending up into the abdomen. It resembled quite closely a fœtal head (Fig. 1).

Cystoscopy was impossible as the cystoscope would not enter the bladder.

A phenolsulphonephthalein intramuscular test showed a relative kidney insufficiency. The amount for first hour was 10 per cent, for second hour 22.5 per cent, total 32.5 per cent.

Operation, February 25, 1918, by Dr. MacKenzie. A median suprapubic incision was made and a large stone filling the bladder was palpated. The peritoneum was reflected from the vault of the bladder to the trigone. The bladder was opened with a 4 inch incision. The calculus was immovable, being fairly impacted in the pelvis. With difficulty it was freed and delivered manually. Many fragments and scales were broken off and removed. The bladder mucosa could not be identified as such. There was a small, smooth, amber-colored calculus in the prostatic urethra. The wound was closed with a suprapubic tube in position and syphon drainage was attached.

During the first week the temperature ranged between 97° and 100° with the pulse from 80 to 124, then it remained normal for the whole of the convalescence. The bladder was irrigated daily and a urethral retention catheter kept the patient dry.

On April 17, cystoscopic report states: "Instrument easily introduced through a normal urethra. Both ureteral orifices normal in size, shape and position. There is a moderately large, dark-colored calculus on the floor of the bladder. Numerous pea-sized fragments were removed through cystoscope."

On April 18, under nitrous-oxide-gas the wound was opened, the small calculus was removed, and the débris washed out. A suprapubic tube was inserted with syphon drainage. From then the convalescence was uneventful, save for a right epididymitis lasting a week. The wound closed except for a pinpoint sinus which opened at intervals.

On July 2, patient was cystoscoped previous to discharge. The report states: "Bladder mucosa much improved since previous examination. Some sand and slough easily were washed out. There is a pinpoint sinus at the site of the suprapubic wound."

On July 4, discharged. The general condition of the patient was excellent. The pinpoint sinus does not dampen dressing in twelve hours. He had perfect urinary control.

The patient was readmitted on September 22, 1918, with a suprapubic sinus from the bladder. On September 26, he was operated upon. The sinus was dissected out and the bladder freed. A calcareous deposit round the neck of the bladder was removed and the wound closed with a catheter in the urethra.

Discharged December 5, with sinus closed. General condition normal.

Description of calculus. The calculus weighed 38.5 ounces (1,155 grams) in the moist state. This did not include any of the flakes and fragments which were lost during the removal and which would have at least brought the total weight up to 40 ounces. It was ovoid, light brown in color, smooth and flaked easily. It measured 9.6 x 14.2 centimeters with a circumference of 36 centimeters (Fig. 2).

The calculus was sawed through and its cut surface resembled the cross section of a tree, being built up of numerous, concentric, yellowish white lamellæ about 20 in number. It was apparently of the same composition throughout, no distinct nucleus or foreign body being present (Fig. 3).

Chemical analysis showed urates, calcium, oxalate, and earthy phosphates. The urates were the predominating salts. Mucin was also present.

Vesical calculi may originate in the bladder or may start in the kidney and pass downward and there grow by accretion. They are found by far the commonest in old men and young children. In women they are rare on account of the short and relatively large urethra and the rarity of residual urine.

Recent investigations with application of the principles of colloid chemistry to the formation of urinary calculi, although suggestive of the actual cause of lithogenesis, as yet fail to elucidate the primary impetus for the beginning of these structures in the human body, as well as the reason for the increase in size and the variable form and density of the individual substances.

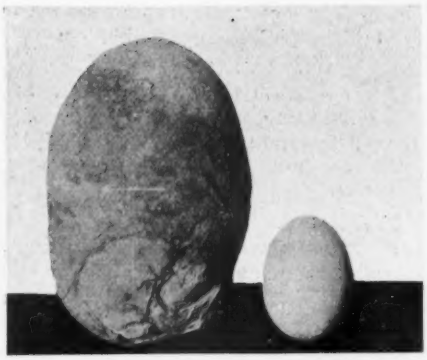

Fig. 2. Calculus with hen's egg for comparison.

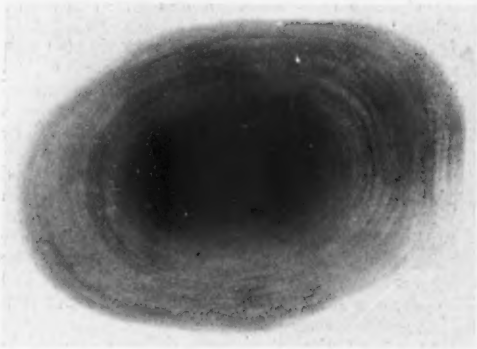

Fig. 3. Cross section of calculus.

Schlagintweit (1) in a review of 326 vesical calculi found that 216 were formed in the kidney; namely, 212 urates and 4 phosphates. Two-thirds of these vesical calculi had accordingly originated in the kidney, the remaining third evidently having originated in the bladder; namely, 44 urates and 66 phosphates, total 110. Some of these 44 urates which originated in the bladder may possibly have been derived from the kidney, although this could not be positively demonstrated. In the case of 70 phosphates, it is certain, however, that 66 of these were formed in the bladder, namely secondarily, through fermentation, in the ordinary way. Only four of the phosphates (as compared to 212 urates) had come down from the kidney. As a marked distinction from the urates, vesical phosphatic calculi are secondary and form in the bladder itself, in about 92 per cent of the cases. In a general way, the kidney must be considered as the source of most vesical calculi, phosphates originating almost solely secondarily in the bladder itself. The rapidity of formation and the rate of growth of the calculi are very variable. Whereas phosphates will form very rapidly around a foreign body, other calculi may increase in size only very gradually. Large stones are always of a mixed composition.

In a careful bibliographical investigation we could find no report of as large a calculus as in our case, which had been successfully removed entire, with complete recovery of the patient.

The large vesical calculi reported may be divided into three classes: (1) calculi found at autopsy; (2) calculi removed with subsequent death of patient; (3) calculi removed with recovery of patient. In the first class are recorded several interesting cases.

A. Specimen No. 283, from the Dupuytren Museum. It weighs 53.305 ounces and was found in 1690 at an autopsy performed in the Charité Hospital, Paris. The patient died at the age of 47, and had suffered with symptoms referable to vesical calculus since the age of 7.

B. Langenbuch (2) reports a case which had been under his observation. An operation was considered inadvisable. The patient died and at autopsy a bladder stone 25.4 ounces in weight was present. It had a nucleus composed of uric acid.

In the second class the recorded cases are more numerous.

A. The largest calculus that we discovered was in a case operated upon by Cline, as referred to in Watson and Cunningham's *Genito-Urinary Diseases* (3). It weighed 46 ounces. The patient did not recover.

B. Two calculi are reported, each of which weighed 44 ounces. The first of these was a case in 1807 in London, England, by an unknown operator, who had to leave his task unfinished on account of the patient's condition. The patient ultimately died. The calculus is preserved in the Hunterian Museum. In the second case, Earle (4) attempted to remove the stone by the perineal route. Only a portion of it was obtained and the patient died ten days later. At autopsy the stone was found to weigh 44 ounces.

In Ashurst's *International Encyclopædia of Surgery* four cases are referred to, of calculi weighing 40.5 ounces (Utteryhowen), 32 ounces (Dupres), 31

ounces (DeGuise, 5), and 22 ounces (Ortellius). The result in each case was fatal.

Interesting is the case reported by Cayley (6), of a bladder stone weighing 25.5 ounces. Here a lateral lithotomy was first attempted but had to be supplemented by the suprapubic route as the stone was too large for extraction through the perineum. The patient died on the third day.

Coming to the class to which this calculus belongs, the largest one we found was in a case operated upon by Milton (7) of Cairo, Egypt. The largest stone removed by him, in a locality where vesical calculi are common, is one which weighed 34.5 ounces. The patient survived the first operation, but succumbed following operation for renal calculus, two and one-half months later.

Genonville (8) removed successfully a stone weighing 20.1108 ounces.

Samuel Gross (9) quotes A. Dunlap as having successfully extracted a vesical stone weighing 20 ounces, having at first crushed it into numerous fragments.

Many other cases are reported of calculi weighing from 17 to 4 ounces. Some of these are reported on account of their size, others for various reasons, such as foreign body nucleus, etc.

The chief interest in the author's case lies in the enormous size of the stone, but there are two other very interesting and instructive points. A differential diagnosis between advanced carcinoma of prostate and a large vesical calculus could not be made by rectal examination, or by the usual physical examination. It necessitated passage of sounds and X-ray. The marked improvement in the general condition of the patient was due partly to the direct removal of the stone and partly to the removal of the urinary obstruction. The same result "back pressure" had obtained as is seen in prostatism, urethral stricture, etc. By removing the obstruction the back pressure on the kidneys was relieved; and they in turn regained a more normal functioning power while the dilated and infected ureters were allowed to drain.

The high rate of mortality in operations for large vesical calculi is due, we think, to the coexisting pyelitis and poorly functioning kidneys and not to the trauma and shock caused by the actual removal of the stone.

As regards removal of vesical calculi, there are three methods at hand: (1) crushing and evacuation; (2) perineal lithotomy, (3) suprapubic lithotomy.

The class of stone adapted for crushing are the small or moderately small calculi, in young healthy individuals, with relatively normal bladders and kidney function.

Litholapaxy is distinctly contra-indicated (1) when associated with benign or malignant growths, (2) in seriously diseased inflammatory bladders, (3) in stones in diverticula, (4) in large stones.

These exceptions are more particularly true if the patient is in middle or past middle life.

In these cases the removal suprapubically under local anæsthesia causes less shock and a much less stormy convalescence. The perineal route, except when there are urethral indications, is abandoned.

I wish to thank Dr. D. W. MacKenzie, Chief of the Department, for the privilege of reporting the case, Dr. Morgan of the X-ray Department, and Dr. Joseph Walker of the House Staff, for the photographs.

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UTERUS BICORNIS UNICOLLIS WITH TWO OVA IMPLANTED IN ONE HORN AND A FIBROID IN THE OTHER[1]

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UTERUS bicornis unicollis is not such a rare condition that a report of the usual case would be of interest. The present case is given because of the mistake in diagnosis and the unusual pathology present.

Mrs. L. F., age 36, came to the Chicago Lying-In Hospital, May 11, 1918, with the following history: She had had a cold beginning four weeks ago at which time she coughed considerably and had pains in the chest, with chills and fever. She was in bed for three weeks. During the past two months she had had colic-like pains in both lower quadrants of the abdomen. They had been worse in the left side and on exertion. She had had pains during her "cold," and on May 7, after washing clothes, she felt "sick," with pains in the sides, which gradually grew worse. There was also burning pain in the back. On the 8th, she noticed a bloody vaginal discharge and was told by the physician to remain in bed. The bloody discharge stopped on the 9th. When she walked she felt very heavy in the vaginal region and as if everything were pressing out. When she entered the hospital she complained of severe pain in the lower abdomen, especially on the left side. There had been no acute attack of pain. When she was quiet in bed the pain was much better.

Family history. Father, living and well; mother had pulmonary tuberculosis; three brothers living and well; four sisters living and well.

Previous illnesses. She had had scarlet fever in childhood. She had had no operations, nor abscessed teeth. She had had convulsions shortly after marriage.

Menstrual history. Menstruation began at 13, was regular, 7-day type, painful and profuse.

Obstetric history. The patient was married at 18, and had her first baby at 19. She felt bad during pregnancy. Delivery was instrumental and the baby died on the third day. The cause of death was unknown, although she stated it vomited blood. The second baby was born at 20. Delivery was instrumental but the baby lived. Following this she had a spontaneous miscarriage at three months. When she was 23, her next child was born and this was instrumental and the child lived to be 11 years of age. Her next child was born at 26, spontaneous delivery, and the child is now 10 years old.

Her last period was March 10, 1918, at which time she flowed profusely. She has not been pregnant for 10 years, during which time she "has not felt well inside." No one advised her that she had an abnormal condition of the uterus. No one stated that she had two uteri.

Examination. The patient is a rather large, heavy-set woman, and does not present the appearance of being very sick. She is not pale, nor does she have the facial expression of one in severe pain. The head and neck are negative except for a bad set of teeth and a few cervical glands. There is no thyroid enlargement. The heart and lungs present nothing abnormal. There are no signs of rickets. The abdomen is somewhat distended and resonant throughout. On palpation there are no areas of tenderness above the umbilicus, but below this point the patient complained of pain on pressure, especially over the left side.

On vaginal examination, it was noted that the perineum was badly lacerated. A small cystocele and rectocele were present. The cervix was lacerated and showed evidence of previous labors, but there was only one cervix. On the left side, it was noted there was a soft boggy mass about the size of a grape fruit. This mass was tender and freely movable. Slightly to the right of the median line another globular mass was found which was hard and taken to be the body of the uterus. This contained a moderate-sized fibroid as it appeared later. The right tube and ovary were easily palpable. The reflexes were normal throughout. No varicosities were present in the extremities. The temperature, pulse, and respiration were normal.

On these findings a diagnosis was made of a probable unruptured ectopic pregnancy with fibroid uterus.

The patient was operated on four days later and a median incision made from the umbilicus to the upper margin of the bladder, and two uteri were found, each about the size of a grapefruit. Each uterus had only one tube and one ovary attached to it. We then realized we had to deal with a pregnant uterus bicornis unicollis with one horn containing a large fibroid and several smaller ones (Fig. 1). Both cornua with ovaries and tubes attached were removed intact at the junction with the cervix. The left ovary contained the corpora lutea. The right ovary was found to be normal. It was sectioned and one portion sewed in the peritoneal cavity and the other half to the rectal fascia.

The abdomen was closed in the usual manner and the intact specimen was sent to the Department of

[1]Read before the Chicago Gynecological Society, May 16, 1919.

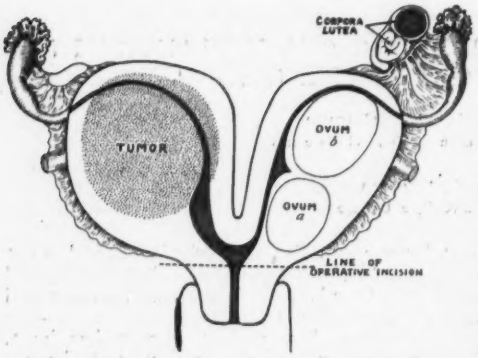

Fig. 1. Diagram of the uterus showing the relations of the horns and the position of the implanted ova. The left ovary only is shown. It was cut longitudinally to show the hollow (upper) and solid (lower) corpus luteum.

Fig. 2. A photograph of embryo, *a* (at left) 2.3 diameters (note the flattened nasofrontal region) and of embryo, *b*, 2.3 diameters.

Anatomy, University of Chicago, where examinations were made.

The patient recovered from the operation very quickly and left the hospital on the thirteenth day.

Owing to the fact that this patient was extremely fat, it was difficult to outline definitely the abdominal contents. If she had been thin, it might have been possible to have made a definite diagnosis of her condition previous to operation. After the condition was recognized, the problem of how to handle the situation presented itself—

Should the abdomen have been closed without further interference?

Should the fibroid portion have been removed alone?

Should the fibroid have been shelled out?

Or, should both uteri have been taken out?

Our reasoning was as follows: The patient was near the age of menopause; she had two living children, and her economic condition was not of the best.

It was impossible to state from which portion the bleeding came. We thought an impending abortion caused it. If so there was no occasion to try to save the pregnant uterus. If the fibroid uterus were removed the trauma caused to the adjacent wall of the pregnant side would be sufficient to produce an abortion and probably a separation of the wound in the side of the cervix, with general peritonitis. Shelling the fibroid out would leave a large number of smaller tumors, with the possibility of further pathology.

Under these circumstances it was decided best to remove the entire mass. The transplanting of the ovary was done in the hope that it would continue to function as a gland of internal secretion.

Subsequent examination showed that the hæmorrhage came from the left (pregnant) horn. This was obvious from the appearance of the implantation site of the lower ovum, *a*, and the absence of any sign of recent hæmorrhage in the right horn. The facts that the bleeding was of short duration and that it subsided upon rest in bed also indicate that it proceeded from an incipient abortion.

The patient was seen May 26, 1919. She had had burning pains shortly after she left the hospital. The hot flushes began about two months after operation and from what the patient states they were not as severe as those experienced in the normal menopause. The area around the ovarian graft in the rectal fascia was normal. No sign of the ovarian graft could be felt nor was there any tenderness. Vaginal examination revealed the small portion of the cervix in good position. It was somewhat flattened. On the left side, about one and one-half inches from the cervix, was a cystic swelling probably connected with the round ligament. It was not painful.

The detailed description of the specimen as prepared by one of us (W. C. E.) is as follows:

As is indicated in the diagram (Fig. 1), the two horns were united only at the cervix. The right horn was greatly enlarged by one large and many minute fibromyomata. In the left horn two ova were implanted, the smaller, *a*, at the cervical, the larger, *b*, at the tubal end of the horn. As has been said, it is probable that the former, *a*, had begun to abort for there was a uterine hæmorrhage during four days preceding the operation and the ovum slipped out intact when the horn was resected. It measured 46 by 32 by 21 millimeters, including the villi, and contained an embryo measuring 23.2 millimeters crown-rump length. This is shown in profile in Figure 2, *a*. It will be noted that it is normal except for a stunted nasofrontal process. There are no reliable clinical data as to the age. According to the estimates of Mall (1918) it would correspond to a stage of 7½ weeks after conception. Histologically both chorion and embryo show excellent preservation with abundant mitosis.

The larger ovum, *b*, was firmly implanted on the ventral (anterior) and mesometral walls of the cornu just below the uterine ostium of the tube. It measured 60 by 50 by 25 millimeters, its long axis corresponding with that of the uterine horn, the shortest with the dorsoventral diameter. It contained a normal living embryo measuring 27.7 millimeters crown-rump length (Fig. 2, *b*) which corresponds to a trifle over eight weeks of development.

The left ovary, which was removed with the horn, measured 20 by 60 millimeters, most of its bulk consisting of two corpora lutea each 16 millimeters in diameter. They are shown in section in Figure 1, and it is apparent that one contains much more lutein tissue, as it is almost solid while the other has a large central cavity. They are histologically identical and contain no lipoid stainable with Sudan III or Scharlach red.

The question naturally arises: Are the two ova from simultaneous or successive ovulations? Is it a case of fraternal twins or superfœtation? The greater size of the ovum *b*, the better developed placenta and embryo indicate that it was several days older than *a*. The fact that one corpus luteum is solid, the other hollow would seem to show that the former is older since both are equal in diameters. On the other hand, corpora lutea of the same age often vary greatly in mac oscopic appearance. There are no microscopic differences between corpora of seven and eight weeks. The difference in the ova and embryos might be due to the more favorable implantation site of *b*. The chorion of *a* is abnormally small as compared to the embryo and the stunted nasal region of the latter as well as the poorly developed placenta may be taken as evidence of inadequate nutrition. The only positive evidence then which favors the interpretation that there were two ovulations, one a week after the other, is the greater amount of lutein tissue in one corpus luteum.

The material was prepared as follows: The extirpated cornua and the left ovary were fixed about an hour after removal, having been kept at room temperature in the interim. The two embryos, the entire chorion of *a*, portions of the implantation site of *b*, and slices of the corpora lutea were placed in formalin chrom-sublimate solution. Other parts of the placenta, *b*, and of the corpora lutea were fixed in the formalin bichromate mixture of Regaud for the study of the mitochondria. The rest of the material and the whole right cornu were preserved in 10-per-cent formalin neutralized with magnesium carbonate. The fixation was therefore fairly prompt and perfect as only small pieces were used and none of the conditions described below can be ascribed to postmortem change or inadequate fixation.

The fibromyoma in the right cornu measured 75 by 62 by 60 millimeters and there were in addition many small tumors of the same kind scattered through the wall. All are of the usual type without any sign of cystic degeneration. In this horn, as in the other, there was a well marked outer longitudinal muscle layer particularly well developed on the anterior surface. This condition reminds one strongly of the longitudinal muscle layer characteristic of the uterine cornua of lower mammals. The endometrium of the right horn presented the rugose velvety appearance of a decidua vera and is histologically indistinguishable from the decidua vera of the left horn in which the ova were implanted. There were blood clots within this decidua but none on the surface. As most of them were organizing they could not have had any relation to the hæmorrhage of the previous week.

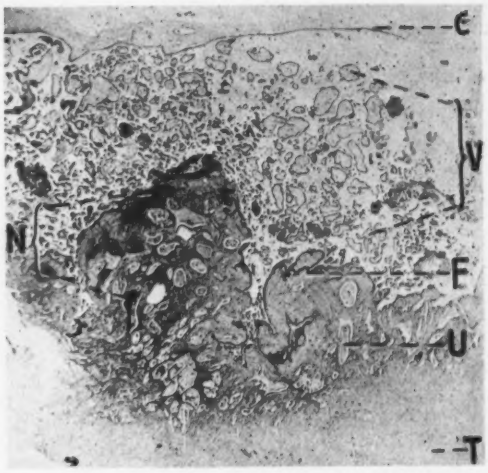

Fig. 3[1]. A general view through the middle of the placental area (x 7), fixed in formalin chrom-sublimate solution, stained with hæmatoxylin and eosin. *c*, Chorionic villi; *v*, villi; *f*, fibrinoid stria; *u*, uterine gland; *t*, tunica muscularis uteri; *n*, necrotic areas.

Histological data. As Figures 3 and 5 show, the placenta of embryo *b* is typical for this stage of development. The figures will serve to describe its general characters, so attention will be called only to certain features. The nomenclature is that employed by Grosser (1909 and 1910).

This ovum was held firmly in place by numerous anchoring villi and there are large areas of proliferating cytotrophoblast ("basal ectoderm"). This is in marked contrast to ovum *a* which shows hardly any basal ectoderm. Trophoblast does not everywhere line the maternal side of the intervillous space in *b*. It is easy to find small areas where nothing separates the decidual cells from the maternal blood except a delicate film of coagulum which does not give a fibrin reaction. There is abundant evidence for the migration of fœtal elements into the decidua. Rows of such cells can be found migrating in single file from the basal ectoderm; these are slender fusiform elements with pycnotic nuclei. In addition, multinuclear masses of protoplasm which closely resemble syncytium can be found among the

[1] Figs. 3, 4 and 5. Photomicrographs of sections of the placenta of *b*. In all, the fœcal side of the placenta is up.

Fig. 4. A portion of the decidua basalis showing compact and spongy layers with a necrotic area in the former. Formalin chrom-sublimate fixation, hæmatoxylin and eosin (x 40). *a. v.*, Anchoring villi; *n*, edge of necrotic area; *v*, villi; *n*, (right), necrotic area showing leucocytic infiltration; *u*, uterine glands; *d*, decidual cells.

Fig. 5. A necrotic area, stained intensely black, extending beyond the fibrinoid stria into a large mass of (fœtal) basal ectoderm. Formalin chrom-sublimate fixation, Heidenhain's iron hæmatoxylin (x 40). *f*, Fibrinoid stria syncytium; *n*, necrosis in basal ectoderm fibrinoid stria; *n. d.*, necrotic area in decidua.

decidual cells. The maternal veins occasionally contain bits of syncytium apparently washed in from the intervillous space. One may further find giant cells especially in the tunica muscularis which may, however, be maternal in origin. The problem of the origin of these various elements is still far from a solution because of the absence of adequate cytological criteria. The present material affords a clue to a possible method of solution. All fœtal elements, notably the trophoblastic cells, seem to be richer than any maternal cells in the peculiar cytoplasmic granules called mitochondria. The inwandering fœtal cells should, in perfectly preserved material, stand out clearly in preparations stained for mitochondria and particularly clearly from the decidual cells which are poor in these granules. Unfortunately this material was not fixed until an hour after it was removed and so these granules are only perfectly preserved in the most superficial parts of the blocks. Small pieces of placenta placed in formol-bichromate solution immediately after removal would doubtless throw much light upon this vexed question.

The only abnormal features of this placenta is the abundance of necrotic areas in the decidua adjoining the intervillous space. The margins of these areas are densely infiltrated with leucocytes and they may cover a region measuring 2 by 5 millimeters. Figures 3, 4 and 5 show the more common forms of these areas. They show a profound necrosis centrally, there may be some hæmorrhage and there is always a margin densely infiltrated with polymorphonuclear leucocytes. While they are usually restricted to the decidua and lie entirely below the fibrin stria of Rohr (Figs. 3 and 4), they may extend up into the trophoblast of an anchoring villus (Fig. 5). One small area was found in the midst of the chorion frondosum which showed some degenerated trophoblast, an incipient leucocytic infiltration and a villus with œdematous stroma. These observations point to a beginning abscess formation with spreading of the infection to the ovum. Slides stained with Gram's stain afforded some inconclusive evidence of the presence of Gram positive cocci but the histological appearance of the necrotic areas points clearly to their infectious origin.

A word should be said concerning the inner or fibrinoid stria of Rohr. While it usually lies immediately below the basal ectoderm of anchoring villi, separating this tissue from the decidual cells, it is by no means a continuous strand. Rarely it extends deeply into the decidua in the form of irregular strands but there is nowhere a well-developed stria of Nitabuch. The inner stria stains homogeneously with eosin and with iron hæmatoxylin but with Mallory's phosphotungstic hæmatoxylin after thorough bleaching with potassium permanganate it may be differentiated into two parts. One of these, usually the more abundant, is amorphous in appearance and stains a more intense pink even

than the collagenic fibers. The other takes the specific opaque blue color of fibrin and may be mingled with the first or separated in a distinct layer. Occasionally it may be wanting. There may be very little of the fibrin or it may be abundant in a given region; sometimes it is absent altogether. In some places this stria is wanting, in others it extends deeply into the decidua in the form of a coarse network. The latter appearance is the only indication of the stria of Nitabuch.

Ovum *a*, as has been said, may have begun to abort. The implantation site does not show the great masses of basal ectoderm anchoring the villi, as is the case in *b*. The villi appear normal, show abundant mitosis in the Langhans layer and a perfect brush border. The extensive infiltration of the decidua by fœtal elements is wanting in this case.

Three factors may be concerned in this: first, the abortion was probably in progress for over a week; second, the implantation site was less favorable than that of ovum *b* and it is quite possible that this ovum was implanted later than *b*.

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INTUSSUSCEPTION OF THE JEJUNUM ASSOCIATED WITH TWO PEDICLED FIBRO-ADENOMATA

REPORT OF A CASE[1]

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AMONG the numerous and varied types of cases received at the U. S. Army General Hospital No. 9, an unusual case of intussusception of the jejunum associated with two pedunculated intraluminar fibro-adenomata, was recently observed and because of the long duration of symptoms and the varied interpretations and ultimate findings, it was of sufficient worth to bear special consideration. The rarity of this type of obstruction occurring in the region of the bowel involved, makes it of special interest.

Pvt. W. B., age 22, colored, farmer; family history negative. About one year prior to his induction into the Army, August 14, 1917, the patient had frequent attacks of a diffuse abdominal pain, but not severe enough to disqualify him from service. He landed in France, February 8, 1918, and did full duty until June 1, 1918, when he was taken with a sudden violent attack of diffuse pain in the abdomen, accompanied by vomiting, constipation and marked prostration. He was removed to the American Red Cross Hospital No. 5 and later sent to Base Hospital No. 8, for observation and treatment. The acute symptoms disappeared after a short time, but recurred at various intervals, rendering him unfit for further service. He was returned to the States, landed at Ellis Island, August 8, 1918, and six days later was sent to U. S. A. General Hospital No. 9, with the various diagnoses as probable gastric or duodenal ulcer, or tuberculous peritonitis. Three doses of salvarsan had been given at Base Hospital No. 8.

On the medical service, his case was carefully studied. Vomiting and constipation occurred at frequent intervals. There was no blood in the stools. At times a small mass was palpable over the left epigastrium. There was no special point of tenderness, but diffuse pain was present over the whole abdomen during these attacks which occurred one-half to three hours after eating. Distention of the epigastrium followed but subsided if vomiting occurred. A slight rise in temperature would follow these exacerbations. An X-ray examination showed what was interpreted to be a prolapsed colon, but nothing else of importance was noticed. Frequent gastric, stool, urine, blood, Wassermann, and genito-urinary analyses were made, all of which were negative. The presence of filaria was disproved. Regardless of the therapeutic measures used, his symptoms continued to recur but his progress-sheet

[1]Presented before the Officers General Conference, U. S. A. General Hospital No. 9, January 14, 1919

records days when he was up and about and absolutely free from symptoms.

Dec. 22, he was referred to the surgical service. An exploratory operation was advised, but this the patient refused to submit to at this time. The attacks recurred at more frequent intervals. He had lost 38 pounds in weight, though his appetite was good, but the ingestion of food was later followed by retching and vomiting of large quantities of fluids with exhausting effects. Laxatives increased his distress and frequent enemata were necessary.

The last week in December, an examination of the gastric contents showed a hyperacidity and contained remnants of undigested food. Stool and blood analysis negative. The patient was very emaciated and his facial expression evidenced great distress. The abdomen was flat except over the left epigastrium, where there was a well-formed mass, but there was no marked tenderness over the stomach or duodenum. The mass referred to was soft to the feel, and upon grasping would disappear but would return later. The presence of an intestinal obstruction was evident. This was substantiated by another series of X-ray pictures and fluoroscopic examinations (First Lieutenant Milton Glover). The stomach emptied itself freely and rapidly, the cap of the duodenum and the walls of the stomach were smooth and free from any crater or depression and showed an absence of gastric or duodenal ulcer or tumor, thus eliminating this condition which had been offered as a probable diagnosis. A picture taken about 15 minutes later with the patient in a prone position, showed a large mass with peculiar, sunburst radiations of bismuth within its boundary in the upper left abdomen, below and indenting the greater curvature of the stomach and extending downward. The presence of an obstruction of the small bowel, high up, was evident, though the exact nature was still problematical. A later picture showed the colon to be normal.

As his condition became more grave, an exploration was made January 2, 1919 through a left rectus incision. The stomach, duodenum, and colon were found to be normal, but a portion of the small bowel was injected and distended. Upon further examination, a mass proving to be an intussusception of the jejunum, containing two intraluminar tumors, one above and one below the point of invagination, 12 inches fron the fossæ of Jonnesco, was delivered from the left epigastrium. The circulation was not impaired and though the bowel was highly injected and swollen there was no evidence of strangulation, but as there was an absence of adhesions of the layers of the involved gut, it was reduced with but little difficulty.

There were no enlarged glands, but the mesentery of the involved section of bowel was more than three times that of normal and contained dense fibrous tissue, showing evidence of former severe inflammatory changes. A further examination of the bowel revealed two fixed pedicled intraluminar tumors about 4 inches apart. Shortly after reduction, there was visible a marked retrogressive peristalsis, with a drawing up of the large tumor into the proximal section of the bowel, showing a tendency toward recurrence. Because of this and the condition of the mesentery, a 10 inch section of the bowel with it's mesentery, was removed, an end-to-end anastomosis was made and the abdomen closed. There was no nausea following the operation, the patient passed gas after the first 36 hours, and made an uneventful recovery, with complete freedom from the former symptoms. The removed section contained two pedunculated tumors, about the size of a golf-ball and olive which the pathologist reported to be benign fibro-adenomata (Fig. 1).

Because of the section of the bowel involved, the presence of tonic waves and a retrogressive peristalsis showing a tendency toward recurrence, when reduced, this case was of special interest. These retrogressive waves are common in the large bowel, but unusual in the small intestine.

As a rule the symptoms of ileus are the same regardless of the causative factors but depend almost wholly upon the degree of obstruction, the region of the bowel involved and the preservation or occlusion of the circulation. The severe colic-like pains followed by vomiting and frequently by a mucous hæmorrhagic bowel movement and later by obstipation, abdominal distention, and shock are the cardinal symptoms of obstruction, but it is not an uncommon occurrence for an impaction of the large bowel, extending over a week's duration, to result only in comparatively mild symptoms, as a headache, or slight degree of malaise. Because of the other different physiological conditions involved, if this same degree of obstruction occurs higher up, the symptoms will always be more violent and may lead to varied interpretations. If the occlusion be complete, or partial, we have an increased peristalsis below the point of obstruction with a complete emptying of the bowel. Above the same increased peristalsis occurs, but later subsides, the fæcal material becomes deposited, secretions and fluids accumulate, and the bowel becomes greatly distended. The contents ferment and undergo putrefactive changes. The bacteria present may pass through the denuded mucous lining and intima into peritoneal tissue and result in a secondary

peritonitis. Even a partial occlusion will result in a stasis in the proximal portion of the bowel, and the toxins here produced have a tendency to cause an inhibitory influence above the point of involvement. This will necessarily extend upward with resulting dilatation of the upper tract, may pass the duodenojejunal fold and produce a similar condition of the duodenum and stomach, and result in symptoms other than ordinarily expected from an intestinal obstruction.

Tumors, either malignant or benign, in the lumen of the bowel are not uncommon but pedunculated masses only are associated with intussusception. They are by far more frequent in the large intestine and of these a large proportion are malignant. In this connection it is interesting to note the greater frequency of involvement of the descending colon and distal sections and associate with this the fact that in fœtal life the formation of the large gut takes place on the left and gradually rotates toward the right. A large series of malignancies recently reported by Judd include 1689 carcinomata of the stomach, 1822 of the large bowel, 5 of the duodenum, 11 of the jejunum, 6 of the ileum and 2 multiple malignant growths of the small intestine. These figures serve to emphasize the rarity of malignant tumors in the small bowel. Any type of tumor is comparatively infrequent in this region, but when present, they are usually benign and project into the lumen as soft masses of varying diameters.

A tumor in the wall of the bowel will not cause invagination as it tends to strengthen it and prevent any folding. It is, however, not uncommon for an obstruction to be caused by a tumor in the wall or outside of the bowel, a malignant or inflamed diverticulum, or a tumor involving some adnexa, but in these cases, pressure occlusions are found. Small tumors, e.g., an enlarged lymphatic gland at the ileocæcal junction, have caused invaginations into the cæcal opening, but this varies from the type of intussusception in question, as in this case we have two sections of the bowel with varied sized lumina as associated factors. Balfour recently reported a case in which a large pedunculated

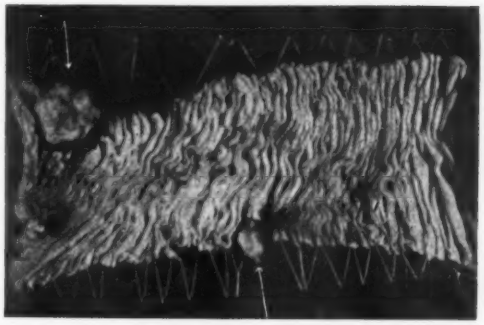

Fig. 1. Section of jejunum with two intraluminar pedicled fibro-adenomata.

papilloma of the sigmoid was associated with intussusception of this portion of the bowel. In his case too these retrogressive waves referred to above were present and there was visible a tendency toward recurrence of the reduced portion. Our observations must have been very similar.

Several theories have been advanced to explain this process of invagination. One is that after the tumor becomes sufficiently large to offer a certain degree of obstruction, it stimulates increased peristalsis which forces it into the lower portion of the intestine with the result that the pedicle pulls upon the portion of the bowel to which it is attached and causes it to invaginate. Another disproves this idea but points to the increased peristalsis produced as the immediate cause of the invagination. The case just cited was of special interest in that a reverse condition too must have existed, evidenced by the various factors enumerated, the observations made at the time of operation and the presence of a tumor above and one below the point of invagination.

Any case showing signs of obstruction without relief, is a surgical one, and if it be severe, procrastination often spells fatality. If the condition remains undetermined and the diagnosis cannot be made otherwise, an exploratory operation is called for. Upon the nature of the obstruction depends the mode of procedure. If a tumor within a small bowel is causing invagination, its removal through a longitudinal incision of the intestine, opposite to the mesenteric attachment,

may be sufficient. But if there is a tendency toward recurrence as was evidenced in this case by the enumerated factors, I believe the wisest plan is to resect the portion of the intestine involved. The operation, if carefully done, ought not to jeopardize the patient's life, but will give more definite and beneficial results. In a similar condition of the large bowel, a resection of the portion involved is advisable as it is a safe plan to consider all these tumors to be of a malignant nature unless a definite proof to the contrary is to be had. The extent of involvement must, of course, be considered and the mode of operation planned accordingly.

CONCLUSIONS

1. A complete or partial obstruction of the bowel will result in a stasis and the formation of toxins which have inhibiting action on the proximal section and cause distention. If this is progressive, symptoms other than those at the original site of involvement will occur and may mask the real conditions.

2. Intramural tumors tend to strengthen the bowel wall and prevent invagination. Only pedicled tumors can be held responsible for intussusception.

3. Tumors of a malignant nature are infrequent in the small bowel but very common in the colon and distal portion of the intestine.

4. Because of the high rate of malignancy, no tumor of the colon should be considered benign until definite proof to the contrary is established. In the upper tract, such proof is not so necessary, but if the tumor is associated with intussusception, the safest procedure which can be followed to prevent a recurrence, is the removal of the section of bowel which is involved, together with the foreign body.

THE SURGICAL TREATMENT OF INFECTIONS OF THE KNEE-JOINT

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THE following extract from a circular prepared in November, 1918, at Savenay, France, will serve as a text for the discussion which follows:

One must discuss the questions of treatment of septic knee-joints by immobilization or with motion and the question of drainage in the later severe septic cases. By the work of Willems it has been adequately shown that certain acute septic knees can be treated to best advantage with adequate drainage and motion. It is obvious, however, that this motion must be intelligently and carefully controlled. It is not to be construed that such patients may be permitted to travel from one hospital to another or to the United States without such immobilization either in a Thomas or plaster-of-Paris splint, that they are protected against traumatism. Any of the septic cases may require additional drainage. All the methods including reflection of the patella have been tried. One of the most valuable incisions for draining the popliteal space has been worked out and used by Captain L. C. Abbott.[1] It consists of about a 4-inch incision along the inner and posterior border at the upper end of the tibia. This is followed up through the space under the insertion of the popliteus into the knee-joint and drains one of the most dependent and difficult-of-access synovial spaces in the joint. This incision may be extended upward over the back of the internal condyle. By keeping in close contact with the bone, the entire popliteal area can be drained with much less risk to the vessels than through any posterior incision.

[1] Now Major.

Knee-joint conditions in France presented themselves in two principal forms first: the so-called internal derangements of the knee-joint and second the acute infections. It is with the acute infections that I desire to deal particularly in this paper. There were great differences among the acute knee-joint infections. For convenience one may divide them into four principal forms:

1. Acute infection of the knee-joint with the formation of pus, but with no opening into the joint.

These conditions arose in connection with and as a consequence of a number of conditions; e.g., acute infections. Arthritis of the knee-joint was seen, of course, associated with pneumonia and various other of the acute general infections. Streptococcus infection was frequently observed following traumatisms of various sorts, direct or indirect. A very considerable number were seen as the result of the injury caused when a man stepped into a shell hole or when he was buried by shell explosion and the knee was given a bad twist at the time. Direct contusion was a frequent cause and acute infections with the formation of pus occurred in which no traumatism nor any demonstrable general infection could be found.

2. A compound injury to the joint, but with no damage to the bone.

A considerable number of patients were seen in which acute infections of the knee-joint with the formation of pus followed penetrating wounds by sharp instruments or in which a machine-gun bullet or a piece of shrapnel had penetrated or traversed the knee-joint without damage to the articular surface or the bones. These were not so rare as one might have supposed. A few cases were seen following exploratory operations on the knee-joint or after the operation for internal semilunar cartilage.

3. A compound fracture of the femur or tibia, involving the joint.

This was the most common finding at the front and the condition resulting was one of the most formidable to treat. The injury was frequently of such a character that immediate serious infections supervened and the damage was often so great that a subsequent satisfactory knee-joint could not be hoped for. Moreover, the so-called débridement operation was frequently employed in injuries of this character so that considerable portions of soft or bony tissues were removed which would have been necessary for a stable knee if one was to have been secured.

4. Late conditions of either 2 or 3 with general sepsis.

Because of the character of the bony tissue both in the condyles of the femur and the upper portion of the tibia serious infectious processes commonly followed such injuries as are described above. When there was considerable loss of substance either in the lower end of the femur or in the upper end of the tibia with subsequent osteomyelitis of the remaining bone, conditions developed both in the extremity and the patient which were most difficult to treat.

After an experience with several hundred of these cases it was our conclusion that the methods of treatment to be employed must be quite different for each of the above classes of cases. The attempt to apply any general method of treatment to septic knee-joints must lead, as it has occasionally already, to the attempt to apply a certain method to all conditions, which, after all, can only be applied to one. This is illustrated in the matter of splinting. There are certain conditions, as pointed out by Willems, in which it is feasible to treat a septic knee-joint and maintain motion so that the patient recovers without ankylosis. There are certain other conditions, however, in which it has been repeatedly shown that serious damage may be done to the knee and risk incurred for the patient unless the injured and inflamed parts are carefully and continuously immobilized. Our conclusions then, with regard to the four classes of patients above specified, were more or less as follows.

In those cases of acute inflammatory arthritis of the knee-joint with the formation of pus with no opening into the joint, it has been demonstrated, we think, by Willems and others, that active and passive motion may be carried on throughout treatment, especially if, as pointed out by them, motion is kept within the limits of pain, and a movable knee-joint secured in certain cases of this sort in which formerly we were accustomed to be satisfied with ankylosis. These joints must, of course, be adequately drained, usually by lateral incisions and the sort of motion instituted which contributes to the emptying of the knee-joint cavity of pus. When without too much pain or without causing any other irritation this motion can be maintained throughout, healing may be secured with good motion. This method had a very limited use in the American hospitals, more limited because of the fact that over-enthusiasm for motion without a full understanding of the limitations of its use caused the method to be used in certain cases where harm resulted. It was also shown we think that in certain cases under group 2 this method may be applied. It must be definitely understood, however, that such cases must absolutely comply with certain conditions.

Only in those cases of acute infection of the knee-joint with the formation of pus which are seen early, in which there is no damage to the bones and in which the damage to the articular surfaces is small, free drainage may be instituted and by the method of Willems the knee-joint kept in motion during the entire course of the inflammatory process. In this way ankylosis may be prevented and a movable knee-joint secured. Willems and others have sufficiently demonstrated this to be a fact.

It is at this point, however, that we think it especially important for the line to be drawn. If the attempt is made, as it has been on numerous occasions, to carry out this same method of treatment in cases with more extensive damage, either traumatic or inflammatory, the risk is greater than is justified.

With regard to the treatment of gunshot or other wounds into the knee-joint without fracture of the adjacent bone structures, we think it has also been adequately demonstrated that an immediate débridement operation may be done, the wound closed at once and the patient secure primary healing with complete function. Or the operation may be done at once, the wound carefully packed or treated by the Carrel-Dakin method and closed by secondary suture when the bacteriological findings are satisfactory.

Let us use the following as an illustrative case: A soldier was struck with a machine-gun bullet which passed from front to back through the outer side of the knee-joint. X-ray examination showed that no damage had been done either to the femur or to the tibia. He was brought into the first aid dressing station within three hours. A débridement operation was done at once and the wounds immediately closed. Healing followed by first intention. A few days later upon being moved to another hospital an acute inflammation of the joint supervened with the formation of pus. Lateral incisions were at once made for drainage. Motion of the knee-joint was maintained, the knee being moved freely twice during each day. During the remainder of the day the knee-joint was flooded with Carrel-Dakin solution. At the end of three weeks' time, bacteriological findings being satisfactory, the wounds were again closed and healing remained complete.

This case, however, is typical of only a very small group seen by the writer. In order to make a comparison, a different case will be described illustrating the danger of the method.

An officer was seen who had had a shrapnel injury several weeks before with slight damage to the upper end of the tibia. The wound was not closed primarily but after a short suppurative course the wound healed and the officer still had about 20 degrees of motion in his knee. As in the previous case transfer from one hospital to another was apparently responsible for a recurrence of acute infection. Considerable redness and swelling developed and the process went on to suppuration in the knee-joint. Lateral openings were made for drainage and the extremity was put up in a Balkan frame with the idea that motion could be maintained. This knee-joint was also carefully treated by the Carrel-Dakin method but twice daily the patient himself, by means of an overhead pulley, extended and flexed the knee-joint as far as he possibly could without too much pain. The knee drained well but the swelling did not subside and the entire area remained red and tender. After several weeks the wounds healed and more serious efforts were made to increase the range of motion. Just as the patient was about to leave his bed, however, another acute exacerbation of the process supervened, osteomyelitis of the tibia developed, and the patient's symptoms were so alarming that an amputation was done just below the middle of the thigh.

Another phase of the subject is illustrated in the following case which was seen in a British hospital.

A private soldier, 32 years old, received a compound fracture injury of the knee-joint, in the fall of 1916. After two or three acute attacks his condition finally settled down to a chronic osteomyelitis involving both the femur and tibia. At the time he was seen by the writer, in the summer of 1917, he had six discharging sinuses from the knee-joint. Partial external dislocation of the head of the tibia had occurred and the knee was fixed in about 25 degrees of flexion. He was able to get about on crutches but was suffering considerably from the effects of prolonged suppuration. In this case the point to decide was as to the relative merits and danger of amputation or resection of the knee-joint. The latter was decided upon and such an operation was performed as is usually done in tuberculous knee-joints of a similar sort. A most gratifying result was obtained in this case, both ankylosis and healing of all sinuses occurring within 10 weeks, so that the man had only about 1.5 inches of shortening and walked very well. He also gained very rapidly in general health.

It is important to observe, however, that a very considerable number of such cases, after a long hard fight to save such an extremity

finally come to the inevitable amputation. In general it may be said that compound injuries to the knee joint with damage to the upper end of the tibia or to the lower end of the femur or both in which serious infection occurs at the time might as a rule better be amputated at once. The extremity which can be saved is in a large majority of cases not a useful one and the risk to life is very great. It may be said that the knee-joint ward at Savenay, where we had 32 beds for the more serious cases of this sort, contained at all times more patients who were seriously sick than almost any area of similar population in our hospital.

One of the most difficult decisions for a surgeon to make is that involved in the cases under group 4. A considerable number of cases was seen of which the following is a typical illustration.

Captain G. came to Savenay with a compound fracture of the femur in the lower third. A considerable amount of pus-pocketing in the soft tissues of the thigh had already occurred when he arrived. He was running a temperature course of from 101° to 103° daily most of the time. A few days after admission he was discovered to have pus in the knee-joint as well. This was drained and the question of amputation considered. It was thought, however, that his condition did not justify amputation at that time. After repeated incisions on three different occasions he seemed to be well drained and his temperature assumed a more normal course. A little later, however, the temperature rose again and new pus pockets were discovered well up into the thigh. His general condition had improved slightly during the two or three weeks of better drainage. Amputation was thought to be necessary to relieve him of much of his infection and insure adequate drainage of the thigh. After a preliminary transfusion he was amputated by the guillotine method through the middle third of the thigh which immediately opened up large pus cavities not only in the soft tissue but in the shaft of the femur as well. No effort was made to get above this area. To the gratification of all of us his condition improved immediately and we had the pleasure of seeing him leave Savenay for the United States, in excellent general condition and with a stump that was almost healed.

One cannot say that all of these cases should be amputated early, but it is certain that in a considerable number, an effort was made to save extremities which by no possibility could have been made useful even if they had been preserved. Also the time often comes when amputation in the presence of general sepsis is a much more formidable procedure than it would have been earlier. The writer is one of those who by reason of the military experience has been converted to the belief that amputation is more often justifiable in these cases than he had formerly thought. *It is important to specify, however, that in those cases where an effort has been made to preserve such an extremity and where general sepis recurs with accumulation of pus in the knee-joint and in pockets up and down the leg and thigh, amputation is not always the first thing to be thought of.* It is our experience that very extensive drainage was often a means of saving a life and of putting the patient in better condition for an amputation which had to be done later. The mortality of thigh amputation in general sepsis during the height of the attack is very high, indeed, and it was demonstrated at Savenay that this mortality can be greatly reduced even if only a few days of complete drainage are provided before the amputation is done. In a few instances also, it was found that reflection of the patella with free opening of the pus pockets and the thigh enabled us to save the extremity while in others amputation became an apparently simple procedure instead of involving a large element of risk which had been observed without the preliminary drainage.

At one time a considerable number of patients with compound fractures of the knee-joint which had become septic were being amputated without much discussion. Our later and more extensive experience convinced us that limbs and lives can be saved by this plan of employing adequate drainage, sometimes if only as a preliminary to an amputation that may be inevitable. One method of drainage is referred to in the introductory paragraph. Another is, of course, by reflection of the patella and postoperative employment of thorough antiseptic treatment. If a patient is carried by his most acute septic period in this way, amputation if necessary can be done later, either through the knee or in the thigh when required. In all of these cases the point of adequate postoperative

splinting must receive the most careful consideration. This may occasionally be accomplished satisfactorily by overhead suspension in the Balkan frame with weight and pulley traction. As a rule, however, the use of the internal traction splint as employed by the British is more satisfactory than anything else.

The method to be used in splinting these patients is essentially the same as that described in femur fractures in the circular already referred to. In cases where the wound will permit its use plaster-of-Paris is the ideal splint. A spica should usually be used in splinting the knee.

The Thomas splint should be applied and cared for always in the same manner. The introduction of individual methods invariably leads to a loss of efficiency, as patients pass from the hands of one surgeon or hospital to another. The following points must be observed. A long splint and a well-fitting ring must be selected. It must be bent to an angle of 10 to 15 degrees at a point 1.5 inches above the level of the knee-joint. Having regard for wounds, the adhesive traction bands (of Sinclair glue or moleskin plaster) must include as much skin of the leg and thigh and extend as high as possible. The traction ropes for twisting attached to the lower end of the adhesive should be of 0.25 inch rope or of 4 ply muslin, fastened very securely into the adhesive, so that it will not give away under a pull of even 15 to 20 pounds. Muslin hammocks of not more than 4 inches in width should be placed across the splint for its entire length at a sufficient tension so that the leg rides well on the top of the splint. The splint is then put on and the traction straps tied firmly over the lower end with the ring tight against the tuberosity of the ischium. A right angle foot piece is put on and the foot and knee bandaged in such a way as to put the entire extremity at rest in the splint. The twisting of the traction bands should have attention once or twice daily. The lower end of the splint should be tied to the outer end of the foot of the bed in such a position that the lower end of the femur rotates slightly outward. The foot of the bed should be raised 12 inches so that the patient's body acts as a counterweight to pull against the anchored splint. By following exactly this technique it has been possible at Savenay to demonstrate an average gain in length of more than 3 centimeters in a series of over 300 cases. In dealing with open wounds in this splint, it is only necessary to release one or two of the 4-inch hammocks. Care must be taken so that the entire area of the fracture is not moved or allowed to sag below the level of the normal anterior curve of the femur.

SUMMARY

In only a few cases belonging to group 2 and in no case of groups 3 and 4 should an attempt be made to secure a movable knee-joint. Ankylosis is the end to be sought with the knee at an angle of from 10 to 20 degrees. Attempts to secure motion, except by very late arthroplasty should be discouraged. In fact the patient of either of these groups who recovers with the ankylosed knee in good walking position can be counted almost as brilliant a result as the one of the other classes who recovers with a movable knee-joint. No attempt should be made to re-establish motion in one of these ankylosed knee-joints except by late arthroplasty. Even such attempts should only be made upon the advice, or in complete harmony with the methods of a surgeon who, like Colonel Baer, for example, knows exactly the field and limitations of this formidable procedure.

OBSERVATIONS UPON INTERNAL PILES

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IT is perhaps a commonplace to say that internal piles constitute a very common complaint, but it is nevertheless true. About 80 per cent of people who have reached middle life suffer from internal piles in some degree of severity. As a rule the disease commences during the latter end of the third or at the early part of the fourth decades of life, and is progressive in character. Occasionally younger people are affected but in them there is usually some predisposing cause, such as hereditary tendency; the association of other diseases denoting general laxity of tissue, e.g., varicose veins of the legs, varicocele, hernia, etc.; or prolonged and severe physical strain. During the Great War I saw a large number of cases of internal piles in an advanced stage of development among quite young soldiers. The age of these patients, between 19 and 25 years, was in marked contrast with that usually observed among patients in civil hospitals and can only be explained by the fact that, during the war, large numbers of young men were suddenly called upon to undergo severe physical training after having been engaged in more or less sedentary occupations for several years.

The disease is progressive in character and passes through definitely recognizable stages. During the early stage, subsequent progress may be indefinitely delayed by judicious treatment, but in the later stages the only satisfactory treatment is surgical eradication.

To ensure efficient treatment a comprehensive knowledge of the pathology of internal piles is essential, so with this end in view I propose to draw attention to some of the observations that I have made during an experience, extending over 20 years, gained in a special hospital for diseases of the rectum.

CLASSIFICATION OF INTERNAL PILES

Three varieties of internal piles are usually described, namely: (a) the arterial, (b) the capillary and (c) the venous. Such a distinction does not really exist and is of no practical value whatever.

An internal pile consists of a conglomeration of blood-vessels in the submucous tissue of the anal canal and of the lower part of the rectum, which have become enlarged and tortuous and whose coats have undergone pathological change, partly hypertrophic and partly fibrotic. Arteries, capillaries, and veins simultaneously participate in this change, so that any given internal pile is made up of a mixture of three kinds of altered blood-vessels. The arbitrary division into the three varieties mentioned above is, no doubt, due to the fact that whereas some piles bleed readily, others do not; and also that whereas some are similar in color to the mucosa, others exhibit a purplish hue. These differences, however, indicate degrees of development rather than variety in structural composition. There is, therefore, only one kind of internal pile and this, during the process of development, undergoes certain changes in external appearance and in structure.

STAGES IN DEVELOPMENT

Internal piles are progressive in development and pass through three distinct stages: (a) primary, (b) intermediate, and (c) final. It does not necessarily follow that all the internal piles present in a given case are in the same stage of development. In fact this very rarely happens, it being a common experience to find that, with the exception of very old standing cases, all the stages are represented.

The primary stage. When seen at this stage an internal pile is small and covered with healthy, unaltered mucosa. Its presence cannot be recognized by digital exploration, owing to the small size of the tumor and to the compressibility of the dilated vessels. It is not sufficiently elongated to allow of it being protruded through the anal orifice, though it may be long enough to permit of the lower extremity being gripped in the sphinc-

teric zone during an expulsive effort. An internal pile in this stage of development bleeds readily, often profusely, whenever engaged in the grip of the sphincters; because the mucous membrane covering it still preserves a delicate structure and has not yet become thickened and tough through long continued friction. The only symptom to which an internal pile at this stage of its history gives rise is *hæmorrhage*. This is often profuse and is repeated with each act of defæcation. The blood passed is bright red in color, a circumstance which no doubt has given rise to the idea that an internal pile in this stage of its existence, is arterial in structure. From the symptomological point of view the equation may be thus represented:

Bleeding—recurrent, often profuse, during defæcation and usually bright red in color.

Protrusion—nil.

The intermediate stage. From constantly being dragged upon by the action of the sphincters during defæcation, an internal pile becomes progressively elongated. When sufficiently elongated to permit of protrusion through the anal orifice, it may be said to have reached the intermediate stage of development. Concomitantly with increase in length, the internal pile increases in bulk partly from increased dilatation of the component vessels and partly from exudation into the areolar connective tissue. From repeated protrusion, the mucosa becomes thickened, with the result that bleeding is less frequent and much less profuse than in the preceding stage. A characteristic feature in regard to protrusion is that the protruded pile becomes spontaneously reduced as soon as the expulsive effort has ceased or almost immediately afterward. After reduction has taken place, protrusion does not recur until the next act of defæcation. Owing to changes in the mucosa, the pile has lost some of its original bright red color. The symptomological equation at this stage is:

Bleeding—less frequent and less copious, several actions of the bowels often taking place without bleeding at all.

Protrusion—occurs with every act of defæcation, is spontaneously reducible and does not tend to recur except during defæcation.

When an internal pile has reached the intermediate stage of development, its presence can readily be detected, by the examining finger, as a thickened longitudinal fold, especially if the finger be rotated upon its axis during the observation. A pile in this stage can also be seen to protrude when the patient forcibly strains down.

The final stage. This stage is considered to have been reached when the protrusion is pronounced, is continuous and does not become spontaneously reduced. The protrusion requires manual reduction after each act of defæcation. Even after manual reduction has been effected, recurrence of the protrusion takes place on slight provocation, such as passing flatus, coughing, sneezing, walking or standing for any length of time. The pile has also increased materially in size, a considerable proportion of its bulk consisting of fibrous tissue. The mucosa, from constant rubbing against the clothing has become thickened and tough. In color the pile has assumed a purplish hue. Bleeding seldom occurs owing to the thickened mucosa. If bleeding occurs from piles which have apparently reached the final stage, it is either due to traumatism or to one of the piles not having passed beyond the primary or intermediate stage.

The symptomological equation during this stage is:

Bleeding—nil.

Protrusion—continuous, unless manually reduced; marked tendency to recurrence during slight exertion.

The recognition that there are *three distinct stages* in the development of an internal pile is of great practical importance, because, in any given case, it is exceptional to find that all the piles have reached the same stage. In fact, it is not uncommon to find that while one pile has reached the final stage, that is to say, is obviously protruded, a second may only come into view when the patient forcibly strains down; whereas a third may not be capable of being protruded at all, and cannot be recognized during digital exploration. Such a pile is still in the primary stage of development, is probably the cause of the bleeding complained of, and may be overlooked when

an operation is being performed. Consequently in such a case, if the obvious piles only are removed while one, still in the early phase of development, is left behind, hæmorrhage, one of the chief symptoms for which an operation for piles is performed, may recur after an interval of a few weeks or months.

THE NUMBER OF INTERNAL PILES WHICH MAY DEVELOP

When every possible internal pile has been developed, such, for instance, as may occur in an old standing case which has never been operated upon, there are usually seven, and only seven piles present. Very exceptionally (.5 per mille) there may be an eighth. This is due to the fact that the branch of the superior hæmorrhoidal artery which is distributed to the right side of the rectum, after reaching the submucous tissue, ultimately breaks up into four branches; whereas that which is distributed to the left side of the rectum breaks up into three branches only, except in rare instances when it may give off a small fourth branch.

In about 70 per cent of cases there are only three or four piles present and these are usually found to be in different stages of development. Even in cases of old standing which have never been subjected to an operation, the full complement of seven piles are seldom present, because, at some time or another, one or more of them may have sloughed away as a result of spontaneous strangulation (*vide infra*).

THE DISTRIBUTION OF BLOOD-VESSELS TO THE TERMINAL PORTION OF THE RECTUM

The arterial supply of the lower portion of the rectum and of the greater part of the anal canal is derived from the superior hæmorrhoidal artery which is the terminal branch of the inferior mesenteric. The superior hæmorrhoidal artery divides into two primary branches: one for distribution to the right side of the rectum and the other to the left side.

On the right side. This branch, after having perforated the muscular coat, enters the submucous tissue and almost immediately divides into two branches: an anterior and a posterior branch. The anterior branch passes down in the right anterior quadrant of the rectum, and finally breaks up in a meshwork of small vessels in the submucous tissue of the anal canal. This branch does not give off any branches.

The posterior branch passes downward in the right posterior quadrant to terminate in a meshwork in the anal canal and on its way gives off two branches, an anterior which passes downward along the line separating the right anterior quadrant from the right posterior quadrant, that is to say, toward the right point in the anal circumference: and a posterior which passes downward in the middle line posteriorly.

On the left side. This vessel after perforating the muscular coat, passes downward in the submucous tissue along a line dividing the left anterior from the left posterior quadrants toward the left point of the anal circumference, and remaining single until near its termination, gives off two branches: one anteriorly which is distributed to the left anterior quadrant and the other posteriorly which supplies the left posterior quadrant.

The distribution of the veins is similar to that of the arteries. They arise in a minute plexus which is found in the submucosa of that portion of the anal canal which is bounded below by Hilton's white line and above by the valves of Morgagni. This zone is known as the pecten.

When pathological changes take place in these vessels, rendering them tortuous, dilated, and thickened, the vessels which are affected first are the larger or main branches. The smaller or secondary branches become involved later. Consequently the first vessels, to undergo pathological change, are those distributed (a) to the right anterior quadrant, (b) to the right posterior quadrant, and (c) to the left point. Hence the piles which result from these early vascular changes may be spoken of as *primary piles.*

Similarly the piles developing in connection with the secondary branches, namely, those distributed (a) to the right point, (b) to the middle line posteriorly, (c) to the left posterior quadrant, and (d) to the left anterior quadrant, may be considered to be *secondary piles.*

THE POSITION OF INTERNAL PILES IN RELATION TO THE CIRCUMFERENCE OF THE ANAL CANAL

Since the anatomical distribution of the various branches of the superior hæmorrhoidal vessels is constant, each branch supplying a definite area of the circumference; it follows that the piles which develop in connection with those vessels preserve an invariable position in relation to the circumference of the anal canal.

The primary piles are three in number and are always found in the same relative position, namely: (1) in the right anterior quadrant, (2) in the right posterior quadrant, and (3) at the left point in the circumference of the anal orifice. Accordingly these primary piles may be designated: the right anterior, the right posterior and the left internal piles.

As above mentioned these three piles are the first to be developed, a fact which I have found to be amply borne out by clinical experience. According to my records, in about 70 per cent of the cases of piles examined, the presence of these three piles is revealed and it therefore appears that this is by far the commonest combination. It does not necessarily follow, however, that all the three piles are in the same stage of development, so that if one of them has only reached the first stage it might escape detection, when an operation is being performed, unless specially looked for.

The secondary piles develop in connection with the primary, and are practically offshoots from them. The arterial branch which is distributed to the right anterior quadrant does not give off a branch; hence a secondary pile is not associated with the right anterior (primary) internal pile.

The arterial branch distributed to the right posterior quadrant gives off two branches and, accordingly, two secondary piles are developed in connection with the right posterior (primary) internal pile, namely: (1) a pile situated at the right point in the anal circumference, the right internal pile; and (2) a pile situated in the middle line posteriorly, the posterior internal pile.

Similarly two secondary piles are developed in connection with the left (primary) internal pile, namely: (1) a pile situated in the left posterior quadrant, the left posterior internal pile; and (2) a pile situated in the left anterior quadrant, the left anterior internal pile. In connection with this latter, there rarely may develop a small anterior internal pile.

The secondary piles, therefore are: the right, the posterior, the left posterior, the left anterior and very rarely the anterior.

There are, therefore, seven or, in very rare instances, eight internal piles which may possibly be developed in any given case and whose position in relation to the circumference of the anal canal is constant. Commencing at the middle line anteriorly and passing around the circumference in a direction opposite to that of the hands of a clock, these piles are:

1. Anterior, very rare (secondary).
2. Right anterior (primary).
3. Right (secondary).
4. Right posterior (primary).
5. Posterior (secondary).
6. Left posterior (secondary).
7. Left (primary).
8. Left anterior (secondary).

The secondary piles are moreover closely connected with the primary piles from which they are developed. Thus, in instances in which all the possible piles are present, the following constant arrangement will invariably be found. The anterior pile, when present, is usually connected with the left anterior above, but is separated from it by a sulcus below.

The right anterior pile is always discreet and is never coalesced with any other pile.

The right pile is practically coalesced with the right posterior, while the posterior, though separated from the right posterior by a sulcus below, is blended with it above.

The left posterior is coalesced with the left, whereas the left anterior is separated by a shallow sulcus from the left. By this arrangement it will be seen that in those instances in which all the possible piles are present, they are formed into three groups:

Group I. Right anterior.

Group II. Right+right posterior+posterior.

Group III. Left posterior+left+left anterior+anterior.

Consequently when performing a ligature operation, it is never necessary to apply more than three ligatures even when seven or eight piles are present.

The practical advantages of bearing in mind the relative position of internal piles are twofold, viz:

1. One knows exactly where to look for the piles and does not run the risk of missing one which happens to be in an early phase of development.

2. It enables one definitely to determine whether supposed postoperative recurrence is due to regrowth of piles which have previously been operated upon, or whether there has been a subsequent development of piles which did not exist at the time of the previous operation,—for instance, if the record of the previous operation reveals that the right anterior, the right posterior and the left internal piles had been removed, and if, when the same patient presents himself on account of a recrudescence of symptoms, it is found that the posterior and the left anterior piles only are present, then it is obvious that the case is not one of recurrence, but is one of subsequent development of piles which did not exist at the previous operation.

EFFECT OF THE PRESENCE OF INTERNAL PILES UPON THE TISSUES OF THE ANAL CANAL

Varicose veins in any situation lead to passive congestion in the tissue from whence they arise. The passive congestion thus engendered ultimately results in fibrous induration. Evidence of such induration as a sequela to passive congestion is well exemplified in the case of the indurated zone in the neighborhood of a varicose ulcer of the leg. The same kind of thing takes place as a result of internal piles. The branches of the superior hæmorrhoidal veins arise in a minute capillary plexus situated in the submucous tissue of the pecten. When these vessels are varicose, this plexus becomes the seat of passive congestion with the result that a deposit of fibrous tissue takes place in the submucous tissue of the pecten. The fibrous deposit takes the form of a circular band, varying in thickness and density, completely surrounding the lower part of the anal canal and situated between the mucous membrane of the pecten and the external sphincter muscle. In well marked instances, the band of fibrous tissue can be distinctly felt and gives an impression to the examining finger such as would be obtained if a rubber umbrella ring had been inserted beneath the skin at the anal margin. I have named this deposit of fibrous tissue in the submucosa of the pecten, the *pecten band.*

The pecten band does not exist in the healthy anal canal. It is purely pathological in origin. It is due to passive congestion engendered either by the varicosity of the superior hæmorrhoidal veins or possibly in some measure to impediment to venous return as a result of habitual pressure upon the veins of the rectum induced by the loaded state of the rectum in the chronically constipated. It varies both in thickness and in density in different cases. It limits the expansibility of the anal orifice just as effectively as would a piece of whipcord if tied loosely around the anal canal. In nearly all cases of internal piles, two characteristic symptoms due to the presence of the pecten band, manifest themselves, apart from those due to the piles themselves. One of these is difficulty in obtaining complete emptying of the rectum during defæcation and the other is diminished size in the caliber of the fæces passed, the motions being generally voided in short pieces about the size of an ordinary index finger. Both of the symptoms are due solely to the presence of the pecten band and both of them disappear when the band has been divided.

The limiting effect of the pecten band upon the degree of relaxability of the external sphincter muscle is responsible for the straining at stool during the passage of formed fæces and also for strangulation of piles when a large mass has become prolapsed through the anal orifice. Such a strangulation is usually considered to be due to spasmodic contraction of the external sphincter under the stimulus of painful protrusion, but it is clearly not due to muscular contraction because a muscle is incapable of keeping up tonic contraction for an indefinite period without relaxation. The construction is due to the unyielding pecten band just in the same

way as the rigid margin of the entrance to the femoral canal constricts the portion of intestine or of omentum which has been forced into it.

TREATMENT OF INTERNAL PILES

When internal piles begin to develop, the disease is progressive in its course. When untreated, piles in the first stage of development soon reach the second and third stages. This is, in large measure, due to the traction exerted upon the hæmorrhoidal tumors by the sphincters during the act of defæcation. A great deal can be done to retard this progressive development by judicious palliative treatment. Constipation should be combated by suitable mild aperients so as to render the motions soft and capable of being voided without undue straining. Drastic purgatives should be avoided. Protruded piles should be immediately replaced. For this purpose the patient should be instructed to pass the index finger, encased in a rubber finger-stall, into the anal canal immediately after an action of the bowels, so as to ensure that the piles are pushed well up beyond the grip of the sphincter muscles. This can be done if the finger be passed as far as the terminal interphalangeal joint. Even in cases in which protrusion has not yet occurred, it is a good plan to get the patient to pass his finger, smeared with ointment, into the anal canal both before and after each action of the bowels for these reasons: first, the lubrication of the surface of the anal canal ensures the transit of the fæces with a minimum of friction, and consequently there is less likelihood of existing piles being pushed down into the grip of the sphincters; secondly, the passage of the finger after an action, ensures that any pile which may have been pushed down, is disengaged from the sphincteric grip. Palliative treatment of this kind, if conscientiously carried out, is often successful in retarding progress through the stages and an operation may never become necessary. In a certain proportion of cases, however, palliative treatment is of little avail and sooner or later an operation becomes inevitable.

Indications for operation. It is quite a mistake to assume that every case, in which the symptoms indicative of internal piles are present, needs operative interference. It often happens that such symptoms entirely subside after a few days' rest in bed with attention to diet and may not be repeated for many months or even years. In such cases it is obviously unnecessary to recommend an operation. When, however, attacks recur at frequent intervals and the symptoms become more pronounced with each successive attack, the question of operative interference must arise.

The indications for operation are two, namely: (1) copious and recurring hæmorrhage; (2) uncontrollable protrusion.

Hæmorrhage. Slight and occasional bleeding is not of much moment but when a patient loses considerable quantities of blood at every action of the bowels, his general health soon begins to suffer. He becomes obviously anæmic and the anæmia is progressive. Under these circumstances the sooner an operation is performed the better. It is a mistake to regard the presence of anæmia as a contra-indication to operation, because the anæmia is being produced by daily losses of blood, and therefore it will increase in severity so long as the hæmorrhage is permitted to recur. It is time enough to take measures for combating the anæmia after the operation has been performed.

Protrusion. So long as the protrusion is amenable to reduction and does not recur until the next act of defæcation, it is only a nuisance and can be tolerated. When, however, the protrusion recurs almost immediately after reduction, after slight exertion such as walking or standing, or during slight expulsive efforts, such as passing flatus or during micturition, the disability becomes a menace to health. A patient suffering from this condition, is precluded from taking adequate exercise, is unable to follow his occupation and his life becomes unendurable. Under these circumstances an operation should be recommended without hesitation.

Selection of an operation. Many operations have been devised from time to time for the cure of internal piles. These fall into four categories, viz: (1) ligature operations, (2) operations by excision, (3) operations by

clamp and cautery, and (4) some form of injection into the tissue of the pile. It does not appear to matter much which particular method be adopted, provided that the operation is performed efficiently. Some methods, however, entail the loss of a considerable amount of blood, so that it would obviously be unwise to select such an operation for a patient who has been reduced to a condition of pronounced anæmia on account of daily copious losses of blood at stool. An operation for internal piles should show 100 per cent of cures. There should be no failures due to the operation itself. The operation should be regarded as having been a failure if (1) the symptoms for which it was undertaken either persist or recur within a period of ten years, (2) if symptoms which did not exist prior to the operation develop immediately afterwards. Failure is due to two causes: (1) faulty technique on the part of the surgeon; (2) sequelæ which are due to the operation itself and therefore out of control of the surgeon.

The first can be remedied by care on the part of the surgeon and by experience; the second can only be combated by discarding that particular operation. As before mentioned an operation for internal piles should show 100 per cent of successful results, and therefore if any particular method of operating is attended by even a small percentage of failures (say 2 or 3 per cent) which cannot be fairly attributed either to want of skill or to lack of experience on the part of the surgeon, that method is bad and should not be practiced.

Preparation before operation. All patients before undergoing an operation for internal piles should be carefully prepared. It is a mistake to think that because the operation is a comparatively simple one, little care need be exercised in this respect. The preparation should extend over two days, during which period the patient should be kept in bed, and should not be allowed to eat and drink whatever he chooses. Moreover he should not be allowed to smoke. Smoking, especially cigarette smoking, in which the smoke is inhaled, often makes the pharynx and the larynx irritable, with the result that after an anæsthetic there is a good deal of mucous secretion necessitating coughing. The act of coughing is felt in the perineum and after an operation for piles causes a great deal of unnecessary pain. The colon should be thoroughly emptied by efficient purgatives and by lavage. Castor oil should never be administered prior to rectal operations because it is often followed by fæcal impaction. A brisk purgative should be given which ensures thorough evacuation of the contents of the colon. For this purpose I find there is nothing more satisfactory than a pill consisting of:

Calomel gr. i
Extracti colocynthidis co. grs. iii
Extracti hyoscyami gr. i

In my private practice I employ the following scheme of preparation:

First day. The patient is kept in bed on a light diet; he is not permitted to smoke or take alcohol. At 10 p.m. he is given two five-grain aperient pills.

Second day. Early in the morning he is given a saline draught such as a Seidlitz powder or an equivalent, followed by a cup of hot tea. After the bowels have acted, a plain water enema (1½ pint, at a temperature of 70°F.) should be administered for purposes of thoroughly emptying the colon. Light diet is allowed—no smoking or alcohol permitted. The patient should remain in bed. At 10 p.m. one aperient pill is administered.

Third day or day of operation. Early in the morning a saline draught should be given. If there has been a satisfactory action of the bowels, it is not necessary to administer an enema, but if the bowels are not inclined to act it is as well to stimulate them to action by that means. The perineum should then be thoroughly cleansed and the surface painted with picric acid solution. It is not necessary to shave the surrounding skin. A sterile dressing is then applied and kept in position by a suitable bandage.

No food of any kind is to be given during the four hours preceding the operation, nor is smoking to be permitted.

Operation. The operation which has been selected is now proceeded with. Personally I prefer a ligature operation to all others. My own method of performing the operation by ligature is as follows:

The patient, having been anæsthetized, is placed in the right lateral and semi-prone position; the following instruments are selected: one ordinary scalpel; one pair scissors (Salmon's pattern); three pairs pile forceps (author's pattern); three pairs pressure forceps, small; No. 16 plaited silk.

First step. Existing piles are usually exposed to view by stretching the external sphincter, but this is not necessary because the external sphincter does not require stretching. When a patient is under an anæsthetic, a normal sphincter can be readily dilated without forcible stretching. It is the pecten band, the pathological result of piles, which limits dilatation. It is very difficult to stretch this band without tearing it, and when torn blood is extravasated into the surrounding tissue. The extravasated blood, if considerable, may end in suppuration or may eventually become fibrous tissue, which still further limits dilatability. Stretching the pecten band, even to partial tearing, does not afford adequate exposure of the piles.

Therefore, I always divide the pecten band with the knife. To do this the index finger of the left hand is passed into the anal canal and its lower margin is everted. The mucocutaneous junction is then divided by a short linear radiating incision in the right posterior quadrant. The pecten band, which is quite superficial is easily recognized by its pearl-white appearance. When the band has been completely divided, the muscular fibers of the external sphincter come into view and should, on no account, be divided. As soon as the division of the pecten band has been completed, the external sphincter can be dilated with ease and the exposure of all existing piles is immediately complete.

Second step. A pair of pressure forceps is then placed on the skin at the anal margin at each of the points in the anal circumference which correspond to the position of the primary piles, viz: at the right anterior, at the right posterior, and at the left points. Slight traction on these forceps at once brings the primary piles in view when the stage of development of each can be ascertained. The presence or absence of secondary piles is also then determined.

Third step. The pile forceps are now placed on the piles. The right anterior pile is always discreet and needs a pair to itself. This pile extends furthest up the rectum so should be seized first, care being taken to grasp it as high up as possible. The right posterior pile is next dealt with. It should be remembered that two secondary piles are developed in connection with this one, so that when present, they should be included in the forceps. Finally the left pile is taken, together with the secondary piles developed in connection with it; namely, the left posterior and the left anterior, when they are present.

Thus it will be seen, that even when seven piles are present, they can be manipulated into three groups so that only three ligatures need be used.

Fourth step. A V-shaped flap of the skin of the anal margin is then raised at the base of each primary pile in succession, commencing with the right anterior and ending with the left. The base of the V is at the mucocutaneous junction. A ligature is then placed in the groove cut by raising this flap and is tied tightly as high up the pile as possible. When the three ligatures have been applied, their ends should be cut short.

Fifth step. The index finger is then passed into the anal canal to free the lumen which has been somewhat constricted by the application of the three ligatures, and then the strangulated piles are returned into the anal canal. The lower ends of the ligatured piles should not be cut away; first, because the stump might slip through the ligature and give rise to serious hæmorrhage; and, second, because, even if actual slipping does not take place, the escape of blood from the tissue of the ligatured pile may cause the pedicle to shrink. When this happens strangulation is no longer complete and the central portion of the pedicle remains viable, with the result that after the pile-slough has separated, the viable portion remains as a small fibrous polypus, which is apt to increase in size and give rise to subsequent trouble. Finally a small pledget of cotton wool, soaked in perchloride of mercury solution (1:500) is introduced into the anal canal and an external dressing applied.

After-treatment. Upon the manner in which after-treatment is carried out depends much of the success of the operation. A good operation may be completely spoiled by carelessness in after-treatment.

An operation for internal piles is attended by a great deal of after-pain. As soon as the patient begins to recover from the anæsthetic he will be conscious of pain in the anal region. This pain increases in severity during the first six hours, after which it gradually subsides and practically disappears at the end of 20 hours after the operation. If the patient becomes very restless and loses control of himself during the first six hours, the pain may be kept up indefinitely. It is important, therefore, that steps be taken to relieve pain as soon as possible. For this purpose a hypodermic injection of ½ grain of morphia should be administered as soon as the patient has returned to bed. A sedative mixture containing opium should then be given at definite intervals, with the object of helping to relieve pain and of preventing the bowels from acting. The following prescription will be found to be useful for this purpose, viz;

Liquor ammonii acetatis, 30 minims
Tinctura catechu, 30 minims
Tinctura opii, 10 minims
Tinctura cardamon co., 60 minims
Spirit chloroformi, 10 minims
Ex aqua cinnamomi, to one ounce

The first dose of this mixture should be given 4 hours after the hypodermic injection and should be repeated at the following intervals: every four hours during the first 24 hours, every 6 hours during the second 24 hours, every 8 hours during the third and fourth 24 hours, until bedtime on the night of the fourth day (reckoning the day of the operation as the first day), when two 5-grain aperient pills will be given. The sedative mixture is to be discontinued after the pills have been taken.

On the morning of the fifth day, a strong dose of sulphate of magnesia or a Seidlitz powder is administered to ensure that the bowels act thoroughly. Unless the aperient is strong enough to produce a fluid evacuation, the process of defæcation will be extremely painful, and the patient will be inclined to refrain from allowing the bowels to act in future, with the probable result that he will get an impaction of fæces. Throughout the remainder of the after-treatment, a mild aperient should be given every night to ensure a free action of the bowels taking place every day.

On the ninth or tenth day after the operation, the pile-sloughs will have separated. These usually come away quite painlessly with the motions without bleeding. In the event of a ligature remaining adherent beyond this period, it can readily be detached by slight traction.

On the twelfth day after the operation, the index finger should be introduced into the anal canal primarily to ascertain whether all the sloughs have separated and secondarily to smooth out the resulting granulating surfaces. Such digital exploration should be carried out every day until the wounds have healed, an event which takes place on the nineteenth day, on an average. The object of the introduction of the finger is to prevent the granulating surfaces adhering together and so leading to some degree of stenosis of the anal canal. If the finger be passed daily, stenosis cannot possibly occur. During the after-treatment the patient must be kept in bed until the fifteenth day, when he may be allowed to get up. On the nineteenth day the pile wounds will have healed and on the twenty-first day the patient may be allowed to proceed to his home.

Diet during the after treatment. During the first four days, that is to say, while the bowels are being confined, the diet should consist chiefly of fluids, e.g., tea, milk and soda, beef tea and toast. No meat or vegetables should be allowed during this period. As soon as the bowels have acted freely on the morning of the fifth day, ordinary diet may be resumed.

Change of dressings. All external dressings are to be changed every morning and evening and, in addition, after each action of the bowels. The peri-anal skin should be carefully cleansed before the dressings are adjusted. The pledget of cotton wool, which was introduced into the anal canal at the operation, need not be touched as it will come away readily when the bowels act.

Micturition after operation. After an operation for piles, spasm of the sphincter muscle of the urinary bladder persists for about 20 hours. During this period, therefore, the patient should not attempt to pass urine; if he does he will probably not be able to do so, and the straining to void urine will prolong the period of spasm, necessitating eventually the use of a catheter, which should be avoided if possible. During this 20-hour period, therefore, it is important that the patient should not be allowed much fluid to drink.

At the expiration of 20 hours, all spasm will have passed off and he will be able to void urine quite naturally, more especially if he is allowed to stand up for the purpose.

Results of the operation. This method of operating yields 100 per cent of successful results. I have performed over 5,000 operations in this way with uniform success. The advantages of the operation are threefold, namely: (1) the loss of blood during the operation is trivial, (2) the time occupied during its performance is short, about three minutes, (3) œdematous tags of anal skin are not left behind.

In the majority of cases, beyond the fact that a triradiate scar, resulting from the removal of the three V-shaped skin flaps, remains, the anus has a perfectly normal appearance.

RECURRENCE AFTER OPERATION

If an internal pile be completely removed, it cannot possibly recur. If a patient who has undergone an operation for internal piles develops symptoms at some subsequent time, one of two things has happened: either, the piles which were existent at the time of the operation were not completely removed, or others have subsequently been developed which did not exist when the operation was performed. From my experience of many thousands of cases, the following rule appears to hold good. If a patient needs an operation for internal piles before he has attained the age of 30, he may not by that time have developed all the piles from which he is liable to suffer. As only piles which exist can be removed, the operation cannot prevent the remaining ones from developing. I have seen this happen over and over again after an interval of from 10 to 15 years. Among my records I have many cases of the following kind:

I performed an operation and noted that I had removed the right anterior, the right posterior, and the left internal piles. After an interval varying from 10 to 15 years, the same patient again presented himself with symptoms of piles. On examination it was found that the posterior and the left anterior piles were present and were the cause of the symptoms. It was obviously not a case of recurrence, but one of subsequent development of piles which did not previously exist. If, however, a patient has reached the age of 40, at that time of life he will have developed all the piles he is ever likely to develop, and therefore, if the existing ones are completely removed, he will never need a second operation. It follows, therefore, from the above observations that an operation for internal piles in a patient under 30 years of age confers immunity for 10 to 15 years only, whereas one performed after the age of 40 years is a permanent cure, provided that it has been efficiently performed. This law is not peculiar to operations performed by the ligature method. It holds good for all methods. Among my records, there are several examples of re-development of piles in those who were operated upon by Whitehead's method before the age of 30 years.

CAUSES OF FAILURE

An operation for internal piles should show 100 per cent of cures. Failure to achieve such a result is due partly to the selection of an operation which carries with it a certain percentage of failures; partly to faulty technique on the part of the surgeon, and partly to careless after-treatment. Apart from these, however, a knowledge of the different stages in the development of piles; of their definite position in relation to the circumference of the anal canal and of a satisfactory method of obtaining complete exposure of all existing piles, will go a long way to enable the surgeon to secure a good result by assisting him in the attainment of thoroughness in technique.

DEPARTMENT OF TECHNIQUE

THE PERMANENT CURE OF INGUINAL AND FEMORAL HERNIA[1]

A Modification of the Standard Operative Procedures

By G. PAUL LA ROQUE, M.D., F.A.C.S., Richmond, Virginia

THE importance of standardization of methods in operative surgery is sufficiently obvious to need no emphasis. Within the past 20 years permanent cures of inguinal hernia, following operation at the hands of good surgeons in proper hospitals, have increased to between 90 and 95 per cent of all cases operated upon. These improvements are due largely to more widely diffused comprehension of the purposes to be accomplished by operative treatment and to the standardization of methods of operative procedure. So long, however, as the standard methods of operating for hernia by qualified surgeons shall fail to cure 10 or 1 per cent of cases, surgical efficiency is less than 100 per cent perfect and it is desirable to make improvements upon even the standard methods of procedure. After all, standard methods are only the best by test of available methods. No method is better than its results and these are not best if they can be made any better.

Whatever other accomplishments may be necessary as a part of an operation designed to cure abdominal hernia, the belief is quite standardized that removal or at least permanent separation from the peritoneal cavity of the entire hernial sac, including its neck, is essential.

The method herein illustrated is offered as a modification of the standard operative procedures employed for the cure of inguinal and femoral hernia. I would state plainly that the procedures are advocated and intended solely as a modification of technique, not to supplant, but to supplement the standard methods already employed. The advantages will be quite apparent by a careful study of the illustrations and may be briefly summarized as follows:

1. The general peritoneal cavity is opened well above the hernia and exploration carefully made.

2. The entire operation is "open," the structures are in good view and all operative work is under constant guidance of the eye.

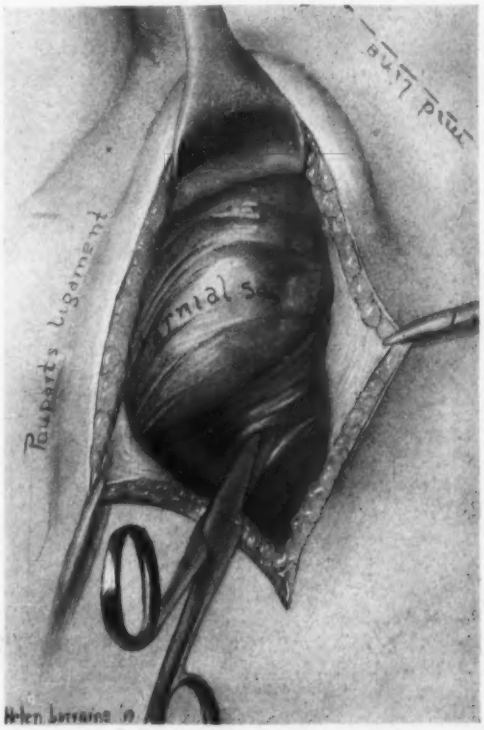


Fig. 1. The usual incision through skin, superficial fascia and aponeuroris exposes the inguinal canal containing the hernial sac and cord. With blunt forceps or scissors inserted between the muscle bundles of the internal oblique and of the transversalis and its fascia about an inch above their lower margin, the bundles are separated in the usual muscle-splitting fashion making a good exposure of the peritoneum well above the neck of the sac. In cases where the muscles are attenuated the arching portion of the internal oblique and transversalis may be retracted to a suitable position well above the neck of the sac. The peritoneum is then picked up and opened in the usual way.

[1] Presented to the Richmond Surgical Society, April 2, 1919

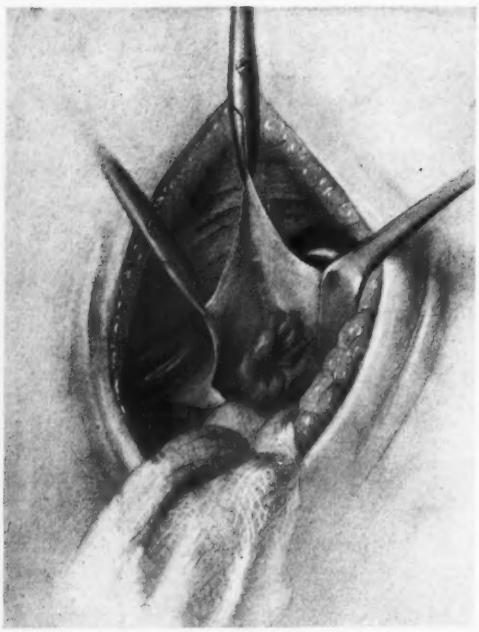


Fig. 2.

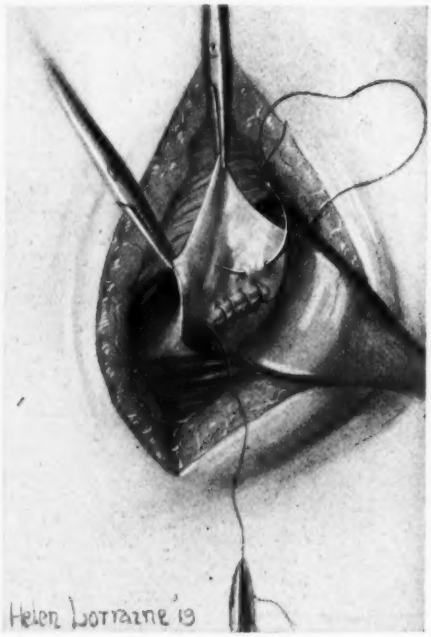


Fig. 3.

Fig. 4.

Fig. 2. After the incision of the peritoneum well above the neck of the sac is made and its edges are retracted, the neck of the hernia is adequately exposed from within the general peritoneal cavity. Adherent bowel and omentum are completely and easily removed and careful exploration of this region of the abdomen is made.

Fig. 3. In certain cases of small size narrow hernia and especially when the repair of the hernia is a part of some operation upon pelvic organs performed through a median incision, the neck of the sac may be tightly sutured, the redundant peritoneum in the region taken up and tightened by two or three rows of sutures and the small narrow hernial sac safely left *in situ*.

Fig. 4. The finger inserted from above through the incision in the peritoneal cavity into the sac, permits easy and complete enucleation of the sac from the spermatic cord, bladder and large blood-vessels for a much higher distance than is ordinarily accomplished by enucleation of an empty sac from below. The bladder, vas deferens, and other structures are constantly in plain view and thus adequately protected against injury.

3. Constricted and adherent bowel and omentum are safely and easily removed from the hernia and structures in the region, and all bleeding points securely ligated.

4. Coincident pathology of the bowel, the appendix and pelvic organs may be recognized and dealt with through the same or a separate incision at the time the operation for hernia is performed.

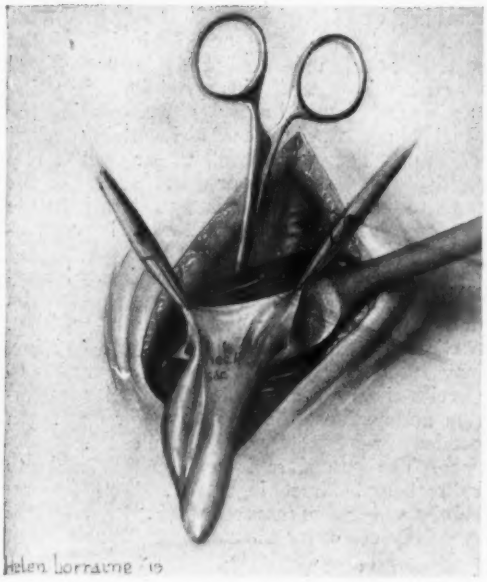


Fig. 5.

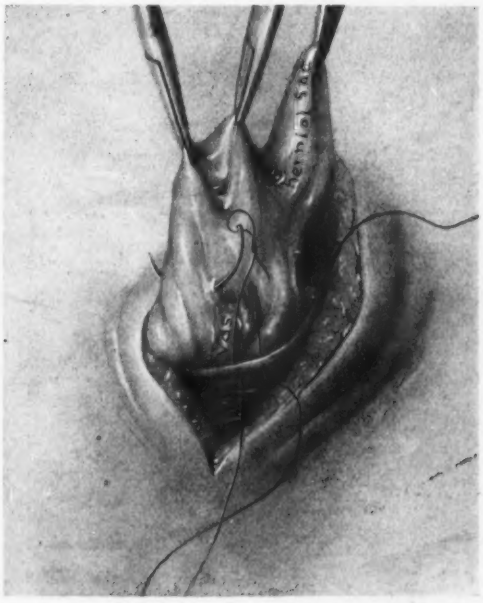


Fig. 6.

Fig. 5. With forceps introduced from the outside, against the finger within at the lowest portion of the sac, the sac is pushed upward and turned inside out into the peritoneal cavity and through the primary incision well above its neck. The vas and vessels of the cord, and bladder are all the time in good view and easily protected against injury.

Fig. 6. With the sac and redundant peritoneum in the region pulled well upward, the bladder and vas in full view, sutures are placed in the peritoneum well above the neck of the sac and to the upper edge of the original incision in the peritoneal cavity. By thus placing the sutures an inch or so above the neck of the sac a high ligation of the sac and redundant peritoneum in the region is insured.

Fig. 7. This suturing completely obliterates the internal ring and lifts the proximal portion of the spermatic cord well above and external to its original location, transplanting it from within. The sutures should also include a small portion of the transversalis fascia which has been inverted with the sac. In hernia of small size in which the amount of tissue is not excessive the sac may be allowed to remain after ligation and the split muscle sutured over them.

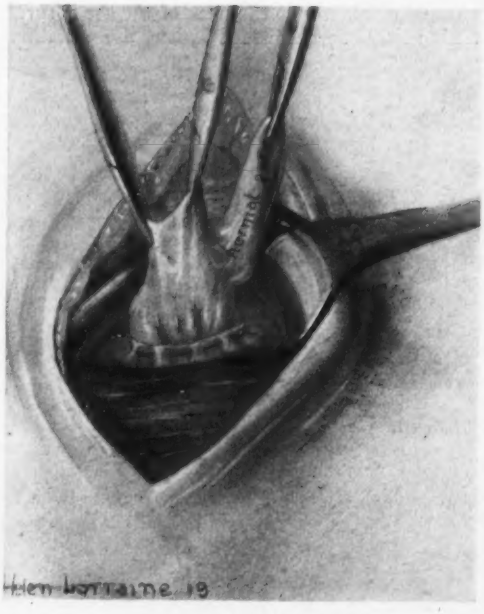


Fig. 7.

5. The bladder, bowel, vas deferens, large vessels, and other structures in the region of the hernia are under constant inspection and adequate protection against injury.

6. Loculation of the sac, sliding and other anomalous forms of hernia, are promptly and immediately recognized and properly treated.

7. Enucleation and removal of the entire sac including the redundant peritoneum in the region

Fig. 8. After suture and ligation, large size thick sacs may be amputated and the split muscle fibres sutured over them. After this the inguinal canal may be closed in the usual standard fashion above or below the spermatic cord as seems advisable in the individual case.

to a point well above the neck of the sac is surely and safely accomplished with the minimum amount of trauma to the cord and other structures in the region.

8. The internal ring and beginning of the spermatic cord can be easily and adequately lifted upward and outward, thus certainly obliterating the internal ring and actually transplanting the proximal portion of the cord at its origin (both of which procedures are useful) rather than merely shifting only the middle or distal portion of the cord to an apparently changed location (the needfulness and permanency of which is questionable).

9. Hernias which have been previously incompletely removed and in which the canal has been properly sutured (so-called recurrences) with a portion of the original sac and its neck remaining, may be completely cured with the least trauma to the cicatricial tissue following the previous operation and without the necessity of reopening a partially or completely obliterated canal.

10. The procedure is equally applicable to indirect and direct inguinal and to femoral hernias and to rare cases of combined types. It is especially useful for difficult, complicated cases.

I have been employing the procedure with progressive satisfaction for some seven years, at first in cases of strangulated and complicated hernia, then in dealing with hernia in women while operating primarily for pelvic disease, and finally as a routine procedure in all cases of inguinal and femoral hernia.

SUSPENSION OF THE UTERUS WITH A STRIP OF FASCIA LATA IN THE TREATMENT OF PROLAPSUS [1]

By LEONARD FREEMAN, M.D., F.A.C.S., Denver, Colorado

THE following method of operating for complete prolapse of the uterus, although it may not be entirely new, has not been widely employed or accurately formulated.

Operative technique. Having obtained access to the abdominal cavity through a median suprapubic incision of sufficient size, the uterus is brought up into the opening and inspected. If the patient is still within the childbearing period, she must be sterilized, best by ligation of the tubes with silk, dividing them, and perhaps folding the severed ends upon themselves.

A strip of fascia lata, about six inches in length and three-fourths inch in width, is then obtained from the outer side of one of the thighs in the following manner: An incision of sufficient length is made through the skin and subcutaneous fat directly down to but not through the glistening-white fascia, and extending along the lateral aspect of the limb, midway between the trochanter and the knee. With a gauze-covered finger the adipose tissue is pushed to either side so as to clear the field and the fascia divided in two parallel lines of the required length. The strip is then loosened and elevated by slipping the handle of a scalpel beneath it and sweeping the instrument from one end to the other. After dividing the attached ends with scissors the strip is removed and enveloped in moist gauze until required. The slit in the fascia lata from which the graft was taken may then be closed with a running suture of chromic gut, although this is not absolutely necessary because no harm will result if it is not done.

Returning to the abdomen, the uterus is held firmly while a closed pair of small, sharp-pointed, curved hæmostatic forceps is plunged from one side to the other directly through the substance of the uterus close beneath the peritoneum covering the fundus, but not penetrating into the cavity—a pair of small, alligator forceps is well adapted to the purpose (Fig. 1, *a*). The forceps should be entered just internal to the attachment of one of the tubes and brought out at a corresponding point upon the opposite side, although if the organ is large it may be well to tunnel it somewhat more anteriorly in order to prevent undue pressure upon the bladder when the uterus is suspended from the tendons of the recti muscles. In order to facilitate the insertion of the forceps, it is occasionally desirable to nick the peritoneum with the point of a knife.

When the forceps have been passed and are still in position, the fascia is doubled longitudinally upon itself, one end seized in the jaws of the instrument and the strip dragged through so that its center rests in the middle of the tunnel and its loose ends project from either side (see illustration). Catgut stitches are then inserted so as to close the openings of the tunnel, thus preventing oozing and holding the fascia in place.

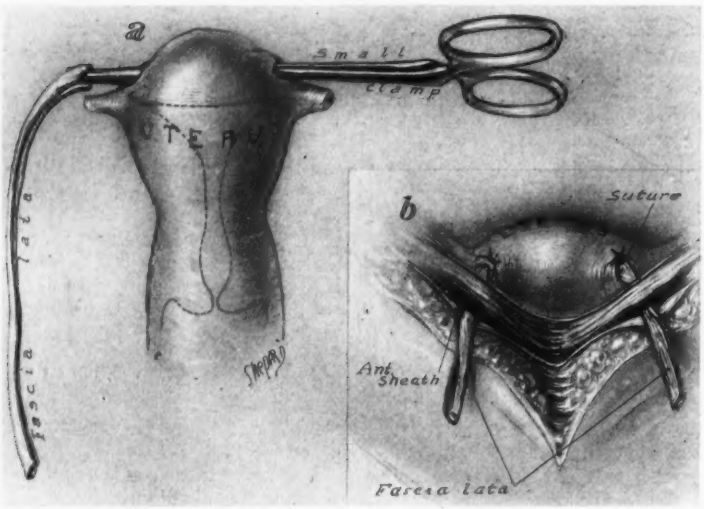
The next step is to secure the ends of the fascia around the tendinous insertions of the recti muscles in order to bind the fundus of the uterus securely and closely to the anterior abdominal wall. This is accomplished first by stripping back the anterior sheaths of the muscles for a short distance above the pubes, so as to uncover the tendons, and plunging through these and the underlying peritoneum from without inward, a pair of pointed hæmostatic forceps with which the ends of the fascial strip are seized and dragged into place, one on either side of the abdominal incision (Fig. 1-*b*).

After the peritoneum is closed, the ends of the fascial strip, which have been retained in forceps to prevent retraction, are pulled tight enough to hold the uterus firmly against the abdominal wall and are then crossed over the median line, best by tying them in a half-knot, and stitched securely to each other in several places by means of chromic gut so that they cannot slip. The wound is then closed in layers. Additional security against slipping may be obtained by catching the ends of the suspending fascia in the bight of a figure-of-eight silkworm-gut suture used in closing the abdominal incision.

Fascia lata has a number of things in its favor: (1) It is easy to obtain in any desired quantity. (2) It is very strong and will not stretch to an appreciable extent, thus differing from the natural supporting ligaments of the uterus. (3) It does not become absorbed, like catgut, but incorporates itself within the tissues and permanently holds the uterus where it is placed.

Strips of fascia from the sheaths of the abdominal recti have been employed to suspend

[1] Read before the Denver City and County Medical Society, May 6, 1919.



Drawing showing author's technique.

the cervical stump of a prolapsed uterus following a preliminary hysterectomy[1]; but this is not as satisfactory as the use of fascia lata, in the manner described, because enough material of sufficient strength is not easy to obtain and there is danger of infection from the cervical canal, to say nothing of the uselessness and danger of removal of the uterus.

During the last few years I have operated upon 11 cases according to the above technique, the first being done on February 11, 1914. There has been no mortality. At the time of checking up the results, all were relieved of their prolapsus, although two were operated upon too recently to be able to speak with certainty of the final outcome.

	Number of Cases
Well at the end of 5 years	1
Well at the end of 3 years	2
Well at the end of 2½ years	1
Well at the end of 1 year	2
Well at the end of 6 months	3
Well at the end of 3 months	1
Well at the end of 1 month	1

Several of these cases have developed ventral hernias. Although it does not seem probable that the operative procedure has much if anything to do with this, nevertheless it may be well to exercise especial care in the closure of the abdominal wounds.

[1]C. U. Collins, Tr. Western Surg. Ass., 1917, p. 153.

One case was particularly instructive because of the opportunity afforded for checking up the internal abdominal condition. At the end of a year it became necessary to operate for a ventral hernia. The uterine fundus was found firmly held in broad apposition against the anterior abdominal wall, just as it had been placed originally, and the strip of fascia lata could still be detected, more or less incorporated in the tissues, as it passed out of the substance of the uterus on either side.

Another case also deserves attention. For certain reasons a badly torn perineum and a fairly large cystocele were not repaired when the uterus was suspended. Although the suspension partly corrected the cystocele, nevertheless at the end of about a year it had increased somewhat in size, while the uterus itself remained firmly in position in spite of the lack of support from below.

From this experience, as well as from general considerations, it is undoubtedly wise to attend carefully to all vaginal repair work even though it may seem superfluous when the uterus is first suspended.

When we have at our disposal so simple and reliable a procedure as the one just described, it would seem unnecessary in most instances, to consider the more complicated and sometimes more dangerous operations for prolapsus, such as hysterectomy, the vaginal operation of Wat-

kins, the Murphy operation, and the burial of the entire uterus within the anterior abdominal wall. In addition to their comparative gravity, these methods are by no means always successful, as most surgeons have had cause to appreciate if they have operated upon many bad cases of uterine prolapsus. In comparison with the advantages of fascial suspension a linear scar upon the lateral aspect of the thigh is of minor importance.

A FENESTRATED BAND IN FRACTURES OF BONE

By ASA W. COLLINS, M.D., San Francisco
Chief Surgeon, French Hospital

IN bone fractures, the prime factor in treatment is a restoration of normal function and this depends on securing proper apposition and its maintenance. Method vies with technical skill in the pursuit of this result. The sum of desired results may be considered almost wholly in reference to apposition and the maintenance of apposition until perfect functional and cosmetic results are secured.

Very happily, the treatment is not often difficult, and the results are excellent in the great majority of uncomplicated fractures of the long bones; but it is in the consideration of the exceptional case that we are now concerned, for it is here that the resources of the surgeon are not infrequently taxed to the uttermost.

The variety of external splints and appliances, even before the great war, would seem to have served every possible aid in this regard but notwithstanding this apparent completeness of applied mechanics, war surgery has made still further additions to our armamentarium and yet, the art of fracture treatment would seem, from time to time, to call on the future for further modification.

In the treatment of fractures of the long bones, I nearly always try reduction and the application of a cast. If the X-ray shows an unsatisfactory result, a second attempt is sometimes made; then, if unsuccessful, operative methods are instituted.

At the operation, reduction is accomplished and if the line of fracture is transverse and the edges well serrated, the tendency will be for them to remain in good position until a cast can be applied and no mechanical appliances are necessary. If, however, we find that the open reduction method alone will not suffice, then it becomes necessary to resort to the application of some internal splint directly to the bone.

Most surgeons are quite familiar with the use of the Lane plate, staple, silver wire, kangaroo tendon and Parham band, as well as the bone graft and dowel, in operation for the adjustment of fragments in fractures. The object of this paper is to add one more appliance to this list, consisting of a fenestrated band and an instrument for its application, which I have devised and used for the past three years.

This fenestrated band is used in cases, which are most apt to prove unsatisfactory with the ordinary methods, to wit:

1. Cases with V shaped fracture, the V forming a loose fragment between the two ends.
2. Long oblique fractures.
3. Comminuted fractures, where we wish to bring a number of fragments into apposition.

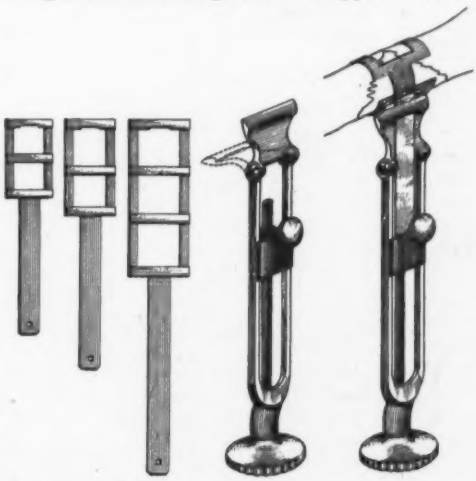


Fig. 1 (at left). Bands ready for application.
Figs. 2 and 3. Instrument used to tighten band by turning screw on the end of the band. When tight the band is locked by pushing on the instrument which bends the tongue of the band upon itself.

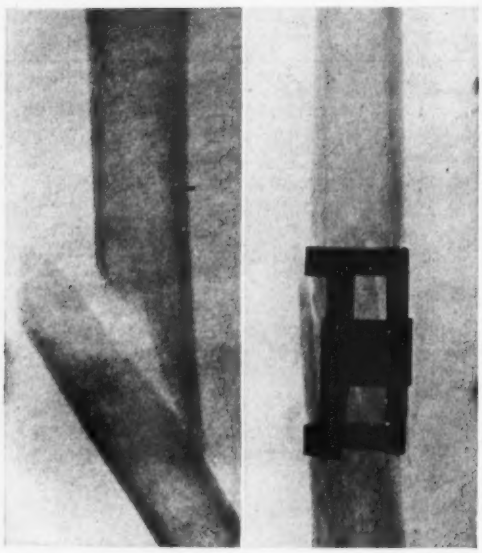


Fig. 4 (at left). Mrs. V. O., case of Dr. F. R. Orella, age 69, good health. Fracture of lower end of left humerus received June 4, 1919. Band applied June 8, 1919.

Fig. 5. Mrs. V. O. Taken soon after application of band. This patient three months after operation has a perfect functional result, with band imbeded in firm callus.

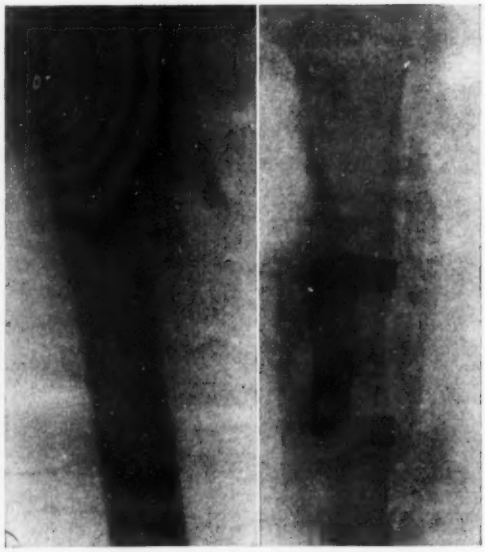


Fig. 6 (at left). Cora F. Girl 7 years old, case of Dr. B. F. Alden. Received a fracture of upper third of left femur July 3, 1919.

Fig. 7. Taken two months after operation and showing the callus enveloping the band. The child has a perfect functional result.

4. Fractures near the joint.

As to the operative technique in the use of the band, very little need be said, as the whole operation is very simple and can be done in a few minutes.

To apply the band, bend it first so as to pass it around the bone. The small end is pushed through the first loop and then into the instrument, where it is firmly held in this instrument, by a screw passing through a small hole in the band. The band is tightened by turning the handle of the instrument until the proper tension is secured, when it is immediately locked by simply pushing on the instrument, which automatically locks the band, by bending it upon itself. The next step is to unscrew the instrument, so as to cut off the end of the band with a pair of scissors about half an inch from where the bending took place and then bend over completely with almost any kind of a blunt instrument.

If we wish to know the circumference of the bone before operation, it can be estimated for practical purposes, by taking the diameter of the bone from the X-ray plate and multiplying by three, then selecting one of the three sizes of bands. It is seldom that any band is required other than the three sizes presumed to be kept on hand. It is hoped that the illustrations herewith submitted, will make evident the simplicity of the band application. When the opposing fragments are brought into place by tightening the band, especially in oblique fractures, the normal apposition is often so definite that the line of fracture can scarcely be discerned in a subsequent X-ray plate. This feature may be appreciated in the X-ray case herewith shown.

I have used the band only on the femur and humerus and the results of these are perfect but I know of two cases, where it was used in compound fractures of the radius and had to be removed. In all of my cases the band was allowed to remain. Any objection to the use of the band would seem also to apply to the Lane plate, as the surface of bone covered by the band is no more than equivalent to that of the plate.

The band will adapt itself to the varying diameter of a bone, such as the end of a long bone, where a plate cannot be used. It was in a comminuted fracture of the lower end of the

femur where the band was first successfully used with an almost complete restoration of function and in this case no other splint could possibly have been used with a like advantage, for the reason that the band accommodated itself to the uneven diameter of the bone and the fragments were thus drawn into the proper position.

It is, of course, essential that the bands should be made of a ductile metal. For this purpose, an alloy of nickel and silver seems to promise the best results, having already been proved to be quite satisfactory. Where the bands are to remain in the tissues, we assume that a greater percentage of nickel would be desirable for the reason that nickel seems to be better tolerated by the tissues than any other metal. The bands are being cut out of 24 gauge plate and the crossbars re-inforced by a piece of the same thickness, which gives the crossbars twice the strength of the side bands.

For the last six months only one size band has been used in all cases and this band has but one window in it. It has been so satisfactory that I believe the future will show us that one size band will meet all cases.

In favor of this design of band, I can state that the time consumed in its application takes but a few minutes; the approximation of the fragments is greater than is possible with any other method and the application is quite simple. I am not offering anything radically new, but a device which surgeons, with considerable experience in bone work, will recognize as a valuable addition to appliances for operative treatment of fractures.

CONTROL OF HÆMORRHAGE IN TONSILLECTOMIES

By WILLIAM R. PARKES, Ph.D., M.D., F.A.C.S., Evanston, Illinois
Senior Attending Surgeon, Evanston Hospital

THAT control of hæmorrhage has greatly disturbed every surgeon attempting tonsillectomies can scarcely be denied. Many general surgeons, brilliant operators in difficult fields, have given up removing tonsils because of the difficulty encountered in controlling bleeding.

I have devised a very simple method that has never failed me in my last hundred tonsillectomies. To my knowledge the method has not been described and because of its simplicity and efficiency I venture a brief description of the procedure.

But two instruments are needed, viz.: two 6-inch hæmostats, one curved and one straight. The straight forceps is armed with a catgut ligature about 12 inches long, held at the very tip of the forceps.

The curved hæmostat is applied to the bleeding vessel, usually found back of the arch of the tonsil pillars. The forceps is now turned about 180 degrees so as to free its point from the surrounding tissue and facilitate the application of the ligature. It is held in this position by an assistant.

The straight forceps armed with the ligature is taken in the right hand, one end of the ligature being held in the left. With the aid of the straight forceps the ligature is passed around the curved forceps, easily hooking the ligature over the point of the forceps. It should be observed that this is done not by the finger but by the forceps which holds the ligature by its very tip.

While the left hand holds the ligature taut the straight forceps still holding the tip of ligature is withdrawn from the mouth so the knot can be started outside the mouth. The knot can be easily tightened around the vessel and the curved forceps readily removed from the bleeder, the tip of the curved forceps never being caught in the ligature. The knot is completed and the ligature cut short. This is all done in less than half the time it takes to tell it, and one can now leave the patient, and as Deaver says, "sleep all night" with never a thought of danger of hæmorrhage. I have never found it necessary to tie more than two bleeding points in one tonsil bed and rarely more than one.

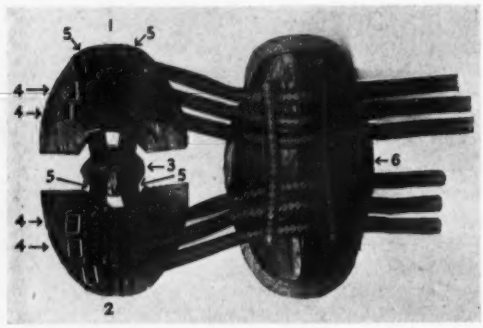
With the prevention of bleeding there is less swallowing of blood, less prostration, and less nausea. The method, therefore, adds greatly to the comfort and safety of the patient to say nothing of the peace of mind of the operator.

This method of application of a ligature is adapted not only to tonsil vessels but to any deep bleeding point not easily accessible to the finger tips. In fact it was in connection with cystic duct vessels and pelvic bleeders that I first used it.

PATELLA SPLINT

By JOHN J. RECTENWALD, M.D., Pittsburgh
Exresident of Philadelphia Hospital

I WISH to illustrate a very practical appliance for fracture of the patella. There are various appliances on the market to hold the fragments of the patella together, but all that I have previously tried have had a tendency to slip. They did not have the enduring adhesive qualities that this method has. The appliance is made of thin leather, straps, and felt pad. In the illustration parts *1* and *2* have a semi-lunar



inlay of sole leather to make them more rigid in their grasp about the patella, *1* thigh piece, *2* leg pad; part *3* is the patella pad, which keeps the fragments of the patella from springing forward; *4, 4, 4, 4* are the straps to hold *1* and *2* tight to skin to prevent slipping; *5, 5*, are straps to pull fragments of bone in close apposition; *6* is felt pad to prevent straps *4, 4, 4, 4* from irritating the skin.

TECHNIQUE

1. The splint should be applied early but not so tightly as to retard the circulation.

2. Apply a mixture of tallow, 1 drachm, to burgundy pitch, 3 ounces "melted," to under surface of parts *1* and *2*, within an inch of the outer border. Apply the pads, one close to the upper, the other close to the lower fragments of the patella and wait until the burgundy pitch has become thoroughly adherent to the skin.

3. Apply the posterior pad of felt or rigid splint, whichever you prefer.

4. Tighten straps *4* which keeps pads from slipping on the skin.

5. When satisfied that pads *1* and *2* are well fixed, tighten straps *5* which brings fragments together and presses patella pad *3* close to the patella and thus prevents the fractured ends from bulging (pressing forward).

The good points about this appliance are that it is a quick method, easily applied, well adapted to the weak and aged, although just as useful for the young. It makes a splendid ambulatory method of treatment, does not expose the patient to infection of the knee-joint, and brings the fragments in perfect apposition. It is a splendid appliance after an open operation to help complete the good work of the surgeon, and well can be worn for months to prevent secondary fracture.

Before closing I wish to state that the most important procedure is the application of burgundy pitch which does its part admirably holding fast for weeks, thus preventing the pads from slipping. I know no reason why an anteroposterior or lateral plaster-of-Paris splint, "Buchanan," cannot be applied over this appliance to make it more serviceable for ambulatory treatments. The method has given me great satisfaction, and I sincerely hope it will be useful to others.

TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING, MAY 16, 1919, WITH THE PRESIDENT, DR. N. SPROAT HEANEY, IN THE CHAIR

PARASITIC MONSTER

DR. ERNEST J. FORD, Evanston, Illinois: Young woman, age 19, robust individual, in the best of health. At normal delivery, a healthy child was born October 30, 1917.

On January 7, 1919, when the patient was pregnant 6 months and 22 days, I was called and I found her suffering severe pain over the gall-bladder region. I administered hypodermically ¼ grains morphine. She did not seem unusually large, and I felt she probably had gall-stones complicating her pregnancy. At 10 a.m. the next day I found her having regular labor pains, and she was immediately admitted to the Evanston Maternity Hospital at 11.45 a.m.; the membranes ruptured at 11:50 a.m., and a copious amount of amniotic fluid (gallons) expelled; at 11:58 a.m. a baby girl was born, which is the specimen we have; at 12.20 p.m. spontaneous expulsion of placenta.

Mall gives a series of over 400 abortions, and a little over 50 per cent of those were pathological. He also quotes from Williams that every fifth to sixth pregnancy ends in abortion. Marschand has given statistics that in 81,187 births 615 were monsters. From these figures Mall has worked out the following tables: of 100,000 pregnancies, 80 per cent resulted in normal children, and 12 per cent in apparently normal abortions; 7 per cent in pathological abortions, and 6 per cent in monsters. He points out that there is a great diminution in pathological abortions after the eighth week. In other words, the embryos, with excessive radical changes, generally aborted, while those less severely affected resulted in monsters. For instance, cases of spina bifida, anencephaly, cleft palate, and ectopia, have been diagnosed by His in embryos less than eight weeks old. As to the causes of these pathological ova and monsters, Mall lays great stress on malnutrition. He also says that in most of the pathological ova the chorionic villi are abnormal.

This monster is of a very rare type. According to Hirst's and Piersoll's classifications, it would come under double parasitic monsters, the epignathus group. Ahlfeld reports 40 such cases. He places in this same group several in which the fœtus grew from the orbit, but none from the nose. Hirst and Piersoll mention one case of a teratoma projecting from the nares. Ahlfeld offers the possible explanation of two embryonal axes close together in a straight line on a single egg; they are head to head, so that as they develop, the stronger overlaps and ultimately destroys the weaker.

DISCUSSION

DR. N. SPROAT HEANEY: This is a most unusual case. I would like to speak about the frequency with which hydramnios is associated with monstrosities. In the ordinary monstrosities, like spina bifida, we see some relationship between the fœtal monstrosity and its association with hydramnios. In this case there is no reason why this sort of monstrosity should be so associated; yet we all know, when we find hydramnios we are liable to have malformation of the fœtus. There must be some relation between monstrosities and hydramnios that is not apparent to us.

DR. DORLAND: Was there a Wassermann made of the mother?

DR. FORD: No.

DR. DORLAND: Did it spring from the nose or the jaw?

DR. FORD: The nose.

DR. HENRY F. LEWIS: What about the other children?

DR. FORD: The first child was healthy, and delivery was normal.

DR. WILLIAM C. DANFORTH: I saw a case of hydramnios; the woman was eight months and had a very large amount of fluid. I made a diagnosis of possible monster. The delivery of the child was perfectly normal except the abdomen was greatly distended, and then a diagnosis was made of congenital cystic kidney. The child, however, did not have a congenital cystic kidney but a congenital stricture of the bowel, a portion of the ileum being greatly distended. The rectum was much smaller than the small bowel, about as large as a lead pencil, the greatly distended portion being filled with meconium. No hæmorrhage occurred. I have never seen anything like this case reported by Dr. Ford.

Dr. GUSTAV KOLISCHER read a paper entitled "Interference in Tumors of the Female Bladder: Their Indications and Technique."

THE USE OF A SEMILUNAR PAD WITH CORSET FOR THE RELIEF OF VISCEROPTOSIS

DR. MILTON M. PORTIS: Visceroptosis, enteroptosis, or splanchnoptosis, Glenard's disease, a disease known by all these names, is an old subject.

A good part of the entire subject is purely speculative. There is no doubt, however, that as time has gone on, and we have made clinical observations of a great many of these people, and have studied seriously the methods of relief for the motley group of symptoms they have, certain facts have come to us in an evolutionary way.

It is known that the disease is much more common in women than in men; in this country it occurs in the proportion of 7 to 1.

There is an enteroptotic habitus in 25 per cent of the women that we see as patients. How common that would be in observations we make in schools, and so on, I do not know.

All observers agree that there are two types of enteroptosis; the congenital and the acquired. The acquired type of visceroptosis is most pronounced in those individuals who have a congenital tendency to this habitus, particularly in women who have had repeated pregnancies, with poor after-care, or who are not blessed with vigor, or with a good figure, where the type of musculature does not lend itself to good repair. Fortunately the acquired type is not the common type, nor is it a difficult one to deal with. There is no doubt at all that a large group of individuals with the enteroptotic habitus go through life without any symptoms at all referable to the condition called visceroptosis. If they happen to be fortunate in their financial condition, so that they can take life with ease and comfort, they can adjust themselves more or less to their surroundings and will go on with perfect comfort; other individuals, with long hours, with poor nutrition, poor hygiene, with worry and strain, will sooner or later have symptoms, and the symptoms they ordinarily develop are those that are described in the textbooks under the head of atony of the stomach and constipation, for they are the two things that loom up. It is also interesting to note, and this has been brought out by methods of study, that a great many of the individuals suffering from arrhythmias, extra systoles, are sufferers from visceroptosis. The majority of these cases have the so-called orthostatic variation in blood pressure. The same individual on lying down will have a blood pressure which may vary from 10 to 20 or 30 millimeters as compared with the pressure when standing up, when the blood pressure falls. The majority of these individuals have a low blood pressure. Owing to toxæmia which may have existed for a number of years, cardiovascular changes or degenerative changes occur, the blood pressure rises, and we have a cardiorenal picture. But it is not uncommon to see individuals in whom you expected the blood pressure to be high, to find when you measure their blood pressure that it is 20, 30 or 50 per cent below what you expect it to be. Many of these individuals are sufferers from visceroptosis. Motor insufficiency is more apt to grow worse in the female because, if the pylorus drops down with the duodenum, you do not have motor insufficiency at first. If the hepatic flexure of the colon stays up in its normal location because of its attachment to the diaphragm and liver, and the splenic flexure stays up in place, the transverse colon will drop down, and you have marked symptoms; there is more or less angulation, or an acute flexion at the hepatic flexure and splenic flexure. If, on the other hand, the case is one of acquired relaxation of the ligaments, or a congenital malformation that has dropped down, there is such a relation in the lower part of the abdomen and comparatively mild symptoms. This brings up an interesting point, and I only suggest it to you as it seems plausible to me. I have no proof of it at all, but I have seen in the fluoroscope cases of visceroptosis where the duodenal ligament has remained in place and we have a picture of obstruction at the duodenojejunal junction. It is interesting to observe with the fluoroscope that bismuth as it leaves the stomach will go into the duodenum, and instead of passing down will distend it. The material begins to surge, and you see a reverse peristalsis; very soon, being propelled by the stomach, it will surge downward again. This goes on for several minutes. Case, of Battle Creek, called attention to this several years ago, and it has been noted by a number of other observers. Such individuals suffer from pronounced toxæmias, and they are apt to have the migraine symptom-complex.

In a correct analysis of a case it is important to decide whether or not visceroptosis is present. The X-ray will help us to recognize these cases very readily, to recognize the amount of visceroptosis, the amount of damage the visceroptosis is doing in interference with normal physiologic function, and also to recognize the character of the visceroptosis.

It is not uncommon to see these stomachs descend to the brim of the pelvis, then go into the pelvis, and so low that later on they reach the floor of the pelvis which keeps the viscera from presenting to the outside world. The way the viscera crowd into the pelvis is astonishing sometimes, and if a man is a gynecologist it brings up some interesting points.

I am interested in these cases of visceroptosis from the standpoint of the emptying time of the stomach. I have quite a number of case records of patients with very low stomachs that empty in absolutely the normal time. Then there are cases of visceroptosis because the hepatoduodenal ligament remains high. Such cases do have motor delays, not of high grade, the normal time of emptying of the stomach being fourteen hours, and the symptoms manifested by them are attributed to motor insufficiency. Such conditions in the colon have been described and perhaps they have been emphasized too much by Lane.

What are we going to do in the way of treatment? The big thing for us to do is to urge prophylactic treatment. When we see these individuals with enteroptotic habitus we should urge them to eat properly, never to eat large meals or take large amounts of liquid. We should urge them to lead a type of life that will keep them in the best of

health, so far as rest and food are concerned. We should urge them to seek a kind of occupation, mental and physical, which is compatible with their limitations. That is a hard thing at times to estimate, and still harder to carry out because of the financial condition of the patient. But there is no doubt that these cases are much more common in the well-to-do classes as opposed to the working classes. I do not see many patients with this condition around the Cook County Hospital, but I see many of them at my office. Whether the physical work of the individual has something to do with muscular development, or whether the congenital cases are few, I do not know.

In a mechanical way to help these individuals, many things have been suggested. I put a great many patients in the Rose bandage. I have tried things that an instrument maker made for me; I have tried various types of apparatus that all of you have had more or less experience with, such as pneumatic pad, and what not. I did not know how much I really accomplished. When I became the possessor of a fluoroscope, I put patients under the fluoroscope machine, both lean and fat, and found the results were largely psychic. I was more or less disgusted. When I tried that out definitely with the X-ray, knowing I had something definite with which to hold up the viscera, I accomplished something. I tried out various types of corsets. The women objected to the corset made by the instrument makers because it did not look well; it did not give them proper shape. In trying out various things suggested by the work of others, several years ago I decided on a type of pad to be worn with a front laced corset. I do not claim originality for it, although certain phases of it are original. The nurse takes measurements from the symphysis to the umbilicus, and from the anterior superior crests of the ilium, and then makes a pad as thick as told. The pad is made of a size dependent upon the grade of gastroptosis.

This semilunar pad should be lower at the bottom and thinned out. The excess pressure should be in the lower part of the abdomen.

When the corset is put on the patient is instructed to do so lying down with the hips elevated. She can put a pillow under the hips, elevate the hips higher than the shoulders and strap the corset across.

I do not know how to estimate the psychic factor in these cases. Again, I must emphasize the point that in all of these patients I try the fattening cure. As these patients gain in weight and feel better, I take out half of the pad, and later the entire pad, and have them wear a front laced corset alone. They get whatever they need in a symptomatic and muscular way, so it is possible that a part of the improvemen they show depends on the diet I give them and on other measures rather than on the pad.

Just a word concerning the surgical treatment of visceroptosis. I have never been enthusiastic about the various operations on the stomach that a great many of our surgeons have carried out; nor have I been impressed very much with the types of suspending operations for the colon. However, if I suffered from joint changes and pronounced toxæmia and there was more or less impairment of vision due to the fact there was imperfect elimination of intestinal intoxication in a chemical sense, I would not hesitate to submit myself to some type of operation which might repair or relieve this mechanical obstruction. If I was shown to have Jackson's membrane and it produced mechanical obstruction, I would not hesitate to have an operation done; but I do not think it is right to submit this type of patient to operations indiscriminately, particularly when the diagnosis is not clear, for by so doing we are very apt to convert a latent neurasthenic into a pronounced and active one.

DISCUSSION

DR. CAREY CULBERTSON: Dr. Portis' paper has been extremely interesting to me, because this is a subject that I have not given special attention to for years. I noticed years ago, when working in the dispensary, that many of the patients were suffering from abdominal ptoses and in that way became interested in the subject.

There are several points brought out by Dr. Portis that are quite in line with my own observations, and I am sure with the observations of practically every man who has had to deal extensively with the complaints of women.

When he first stated that 25 per cent suffered from this condition, I was surprised, because that number is considerably in excess of the number that have come under my observation and in excess of the statistics with which I am acquainted.

Surely, at the Cook County Hospital, where we see so many women patients, much less than one in four suffer from enteroptosis; at the same time, it is true, especially in a gynecological way at the County Hospital, the majority of patients are young women who have not reached mid-life. On the other hand, in private practice, in the office, we see a larger percentage of women in whom we have reason to suspect, and many times prove, this condition.

Another point which he brought out is the relation of blood pressure to this underlying fault. I noticed this some years ago when working on blood pressure that there was a rather constant run of low blood pressures in women of the ptotic type. I regret Dr. Portis did not go into a little more detail with respect to that. I should like to ask if it has not been his observation that it is the systolic which drops in these cases rather than the diastolic pressure; that is to say, the diastolic pressure is not lowered in proportion to the lowering of the systolic pressure.

I agree with Dr. Portis with regard to the surgical treatment of these cases. When I was working in the dispensary we used postoperative maternity corsets, and pads were put inside the front part for the treatment of ptosis. There is no question that

the condition of the women was materially improved. Many of these women have large pelves; the bony structure is large and their pelves are wide, so that nearly all the abdominal contents can enter the pelvis. Where the kidneys come down to the brim of the pelvis, it is extremely difficult to pad the individual. For the last four or five years I have been using a different garment made here in Chicago, which is a corset of the straight front type, front laced, with short top. It must be put on when the patient is lying down. It has inside a shelf arrangement rather than a pad.

DR. EUGENE CARY: I think these conditions should be classified as the acquired and congenital, and the treatment for the congenital cases, inasmuch as they are in people well-to-do, should start in infancy. In women with strong pelvic floors, we should thoroughly impress upon them the importance of taking exercise which will bring back tone to the abdominal muscles.

DR. GUSTAV KOLISCHER: With regard to operative interference in cases of floating and so-called wandering kidney, we know that many women who complain of pain in the side and have had their kidneys fixed have been relieved. A few years ago a prominent surgeon came to America and told us that he could practically cure every woman by taking out the colon or anchoring one or both kidneys. He proved it by citing a case in his own family. His wife could not go to church any more, but as soon as he anchored her kidney she was able to go to church again. In such cases the anchoring of kidneys is not a permanent success, and operation is an uncertain quantity in a case of floating kidney. Many methods have been described for the purpose of relieving patients of their ailments, but while we may afford temporary relief, we do not effect a cure. You may anchor a kidney securely in place as determined by palpation, but in spite of it the patient will have stasis. The periodical dilatation of the pelvis of the kidney has nothing to do with mechanical interference but is due to some unknown cause. We know that the best thing we can do with patients who have floating kidneys is to apply a pad which will keep the kidney in position.

I would like to hear Dr. Portis relate his experience in gymnastics.

DR. N. SPROAT HEANEY: The question has occurred to me whether Dr. Portis has ever fluoroscoped any patients who had these visceroptoses especially when the stomach and intestines were low before pregnancy and during pregnancy, because pregnancy is supposed to lift the stomach and colon in position. I would like to ask him whether he has made observations that such a patient with marked symptoms in a nonpregnant condition was relieved by this physiological pad. I wonder what the effect would be where the stomach is close to the pelvic floor, whether the pad would crowd it down further or lift it up. The patient should get in the knee chest position first and then put on the pad.

DR. CHARLES S. BACON: The question has occurred to me how many of the symptoms and discomforts in pregnancy, particularly in primiparæ with this habitus, are due in the beginning of pregnancy to this condition. If so, can this pad be applied in early pregnancy to note the effect of the application of the pad? Also where we have a simple prolapse of the kidney, or a prolapse of the stomach and colon, is this pad good, or is some other form better?

DR. PORTIS (closing): I will try to answer the various questions that have been asked. First, concerning Dr. Culbertson's discussion, I do not wish to be misunderstood. Twenty-five per cent of the individuals that come to us in medical practice have more or less the enteroptotic habitus, but they have not enteroptosis because that does not occur in all of them. The condition starts in childhood. I am not prepared to state the percentage of women who show visceroptosis. Statistics show the proportion of 7 to 1 as far as the census goes.

When the blood pressure is lower than you expect it to be for the age of the individual, the systolic pressure tends to fall more than the diastolic, and the pulse pressure is low.

It is generally agreed that the endocrine glands play a rôle in these cases. I believe that these individuals with the enteroptotic habitus have ductless gland anomalies. The adrenalin tests in such individuals show they are deficient because there is the involvement of the entire group of glands.

In response to the question of Dr. Kolischer, when it comes to the subject of gymnastics, I usually find out whether the patients can afford it, and if they can I have Miss Carlson give these patients instructions for proper gymnastics and deep breathing and knee chest exercises. I do feel it helps them.

Dr. Heaney asked about the effect of pregnancy on the elevation of the stomach and colon. At the time these women become pregnant they are no longer my patients.

In answer to Dr. Bacon's question, if they do become pregnant, any type of pressure of this kind will surely be strongly contra-indicated. I advise them not to wear a pad. Cases of the second grade, where the viscera only descend part of the way into the pelvis, as well as those in which the viscera descend just below the inlet or below the brim of the pelvis, are benefited and the organs are raised by the pad.

UTERUS BICORNIS UNICOLLIS; TWO OVA IN ONE HORN, FIBROID IN THE OTHER

DR. E. L. CORNELL read a paper entitled "Uterus Bicornis Unicollis With Two Ova Implanted in One Horn and a Fibroid in the Other." (See p. 485).